March

25 Cents

Science and Invention

IN PICTURES

THE PERPETUAL MOTION MYTH

See Page 1078

40 NON-TECHNICAL RADIO ARTICLES

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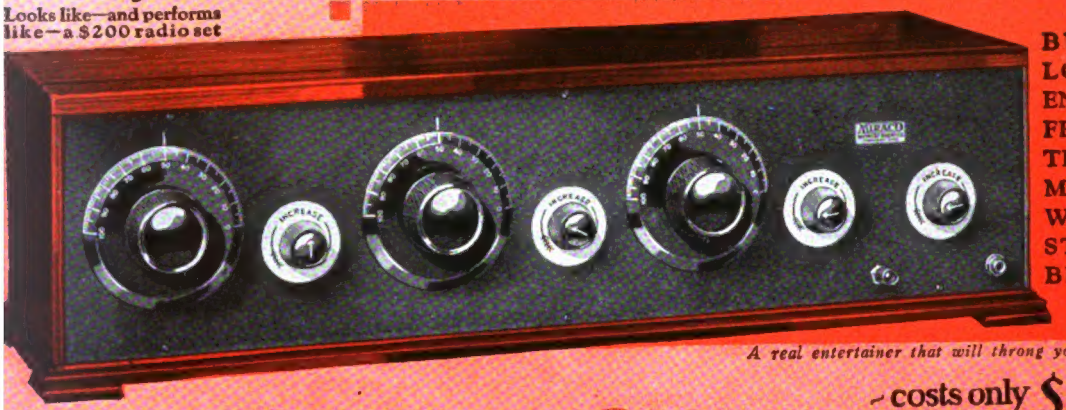
EXPERIMENTER PUBLISHING COMPANY, NEW YORK, PUBLISHERS OF
DIO NEWS - SCIENCE & INVENTION - THE EXPERIMENTER - MOTOR CAMPER & TOU

Combines distance, selectivity, power, deep full tone, beauty and simplicity!

Looks like—and performs like—a $200 radio set



BUILT TO GIVE LOUD SPEAKER ENTERTAINMENT FROM STATIONS THOUSANDS OF MILES DISTANT WHILE LOCAL STATIONS ARE BROADCASTING

A real entertainer that will throng your home with friends!

The Marvelous MIRACO Ultra 5

costs only $75

[FIVE TUBE OUTFIT IN BEAUTIFUL SOLID MAHOGANY CASE]

Send coupon for SPECIAL OFFER!

Completely built, thoroughly tested and factory guaranteed by one of America's oldest and most reliable manufacturers of quality sets! Years of experience and quantity production explain its almost incredible price. Users, who have deluged us with commendations, say that friends who see and hear it are amazed that it sells for less than $150 or $200. Radio experts, who know good construction and quality parts, are equally astonished. You, too, will be delighted, thrilled, amazed with your big five-tube Miraco "Ultra 5" in its beautiful hand-rubbed solid mahogany cabinet! You'll be envied by radio friends who paid big prices for their outfits. Imagine getting all this for $75—a beautiful sweet toned "coast to coast loud speaker" set, composed of finest parts, housed in solid mahogany, equipped with the latest improvements, refinements and features found on costliest sets—and factory guaranteed! An instrument approved by radio's highest authorities! A set anyone can connect and operate. Even beginners learn quickly to cut through the "locals," get distant stations loud and clear, log stations and return to them at will. (Full directions with each set.) It is non-radiating, non-distorting, non-howling. Has cut-out switch—and a first stage phone jack for tuning—on Bakelite panel. All wiring concealed under Bakelite sub-base. Works on storage battery or dry cells. Literature describes other newest features.

"Coast to Coast" reception verified by Miraco Users

NOTE! Do not judge Miraco sets by their prices. Enormous production makes them cost less. They are built—by pioneer set makers—of highest grade parts. They embody improvements, refinement and features used in the most costly sets. Every Miracouser is an enthusiastic booster—these letters are typical of the many we receive.

Maryland Hears Europe
During International Radio Week I received European stations several times upon my Miraco. Who wouldn't be satisfied with results like this?—Jos. E. Cook, Owings Mills, Md.

California Hears East Coast
Miraco works fine. Last night I got Cuba on loud speaker. I also pick up East Coast programs in spite of local interference.—Clinton Elliott, Long Beach, California.

Illinois Hears London
Miraco operates wonderfully. Thursday night I heard the program from the Hotel Savoy, London, for about 35 minutes.—Carl Mackey, White Heath, Ill.

Bermuda Hears California
On my Miraco I have received KGO at Oakland, Cal., a distance of over 3,000 miles four times in last four weeks. Also have received five stations about 2,000 miles away and about twenty over 1,000 miles away.—I. O. L. Spurling, Spanish Pt., Bermuda.

Nevada Hears Cuba
Am able to get all Eastern Coast stations with my Miraco as well as Havana, Cuba and Mexico City. Also all Canadian stations. Had Havana loud enough to broadcast same over telephone a distance of 300 miles.—A. A. Ewing, Rox, Nevada.

Vermont Hears Mexico
I have received stations as far as Mexico City, Mexico, Calgary, Canada, Cuba and Texas on my Miraco.—A. V. Little, Vergennes, Vt.

Mass. Hears Belgium
Nov. 27th at 11:25 P. M. I heard 2LO, London, England, on the Miraco. Nov. 29th at 11:40 P. M. heard SBR, Brussels, Belgium. You can't get a better set for the money.—M. J. Discoe, Pittsfield, Mass.

N. Y. Minister Hears Europe
I tuned in four different European stations last week on my Miraco. My guests and I heard 5NO, Newcastle, England, very clearly—a piano solo from Rigoletto. Also heard voice in Italian announce IRO, Rome, Italy. Concerts from other stations came through but static crashed at their conclusions—one was in Flemish.—Rev. Thos. E. Owen, St. Patrick's Rectory, Rossie, N. Y.

Pennsylvania Hears Calif.
Have listened to Cuba, California and possibly 100 other stations. All who hear Miraco proclaim it the best they have ever heard.—G. H. Stevens, Altoona, Pa.

Mississippi Hears Hawaii
Installed the Miraco myself and I had never had any experience with radio at all. Have gotten Havana, Cuba, and Honolulu.—H. Kittle, Shaw, Miss.

Nebraska Hears Cuba
Miraco is a wizard. I have handled radios for two years—have not seen its equal under $200. Heard Havana, Cuba, Saturday night despite that their language is hard to discern on a radio.—C. G. Stockman, Synder, Neb.

Other Miraco Long Distance Sets $14.35 up

Users tell us that Miraco Model R justly deserves its title, "Radio's finest low priced quality receiver." One tube acts as a tuned radio frequency amplifier and detector combined. A great distance getter. Easy to operate and log. Covers all wave lengths 150 to 625 meters. Like all Miraco sets, it operates on a storage battery or dry cells. Never such value before at only $14.35

MIRACO RADIO GETS 'EM COAST to COAST

This wonderful new Miraco Model R-3 is the three-tube, long distance, loud speaker set that has created such a sensation. Easy to tune and log. Covers wave lengths 150 to 625 meters. Detector acts also as a tuned radio frequency amplifier. 2 stages audio frequency amplification. Has no equal for simplicity, volume, range or clearness at anywhere near its price. **Miraco R-3 only $29.50**

These Miraco sets are as easy as a phonograph to operate. Built throughout of highest grade parts. Full directions for connecting and operating supplied with each set. No experience necessary. The three and four tube sets have cut-out switch and first stage phone jack. Each set completely built, thoroughly tested and factory guaranteed.

The famous Miraco Model MW four tube "coast to coast loud speaker" outfit which users all over the country report outperforms and outdistances much costlier sets. Comes in a solid mahogany cabinet. The improved 1925 model is equipped with cut-out switch, first stage phone jack for tuning (removing plug automatically switches program to loud speaker) and other latest features. Employs one stage of radio frequency amplification, detector and two stages of audio frequency amplification. Another unmatched Miraco value, $54.50.

All the Proof you want is waiting for You!

Reports from the many users in every state prove Miraco Tuned Radio Frequency Receivers—at rock bottom prices—have efficiency of sets costing up to three times as much. Remember that Miraco Sets are the product of a long established, reputable manufacturer—pioneer builders of sets. Send for further evidence that they are Radio's finest moderately priced receivers. All Miraco sets bear the endorsement of radio's highest authorities. Mail coupon now for latest bulletins and plenty of additional testimony from users leaving no doubt that "Miraco Radio Gets 'em Coast to Coast."

DEALERS! JOBBERS!
Write for the new Miraco proposition. Nation-wide use and popularity of Miraco Sets, their amazingly low prices and our extensive advertising, makes them wanted everywhere. Send coupon.

AGENTS!
The wonderful tone, volume and distance-getting ability of Miraco Sets makes them easy to sell. Send coupon for proposition; good territory open.

Send coupon for free bulletins [or order direct from this ad]

MIDWEST RADIO CORPORATION
Pioneer Builders of Sets
Cincinnati, Ohio
409-W East Eighth Street

Send free literature, your SPECIAL OFFER and all particulars regarding Miraco Sets. ( ) Jobber. ( ) Dealer. ( ) Agent. ( ) User.

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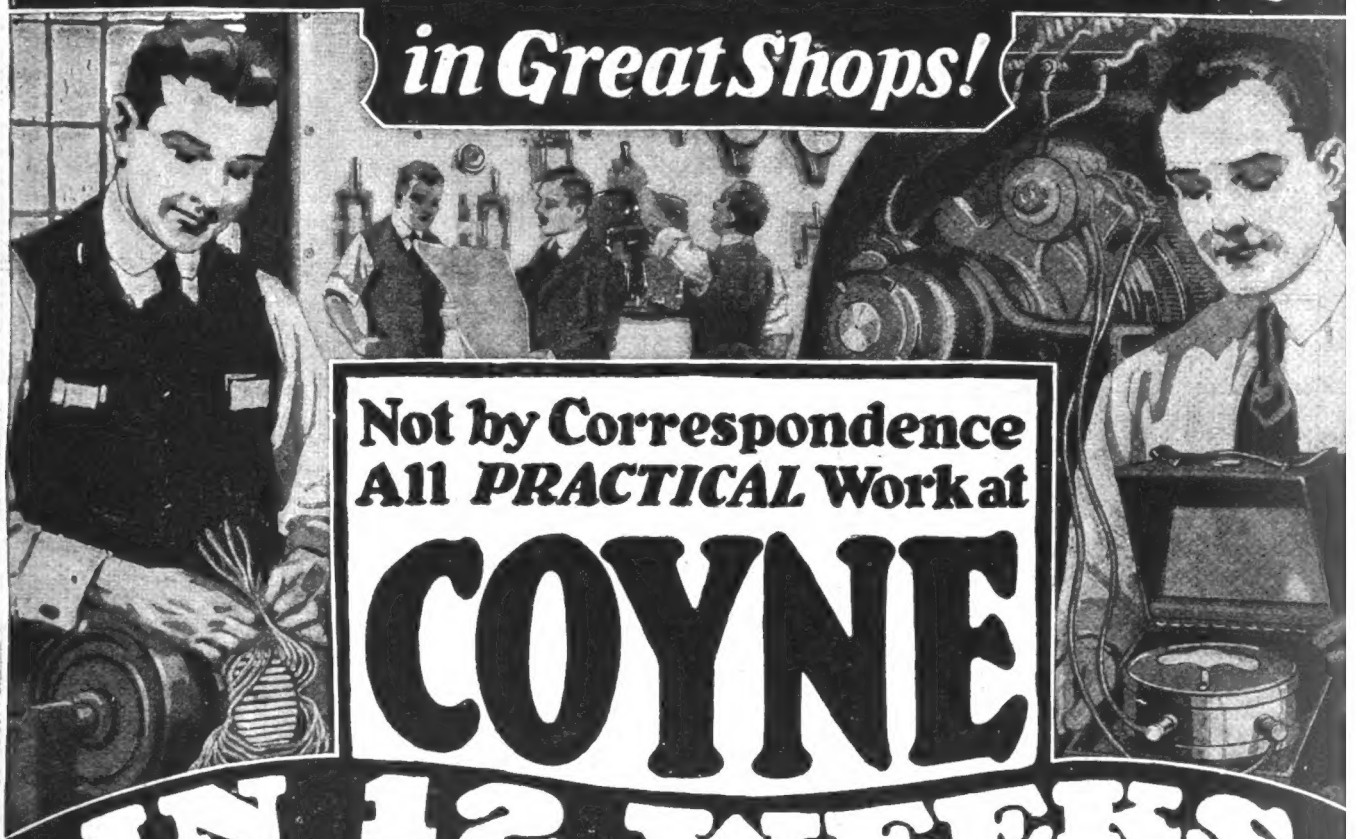
in Great Shops!



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Vol. XII.
Whole No. 143

Science and Invention

FORMERLY
ELECTRICAL EXPERIMENTER

March, 1925
No. 11

IN OUR NEXT ISSUE

Did You Ever See a Battle of Colors?

The story will be told of how colors are made to appear on a screen, swirl around each other, push each other from side to side, and finally form a whirling mass of beautiful colors. Other effects, including the introduction of human figures in shadow and complete flower gardens, are possible with the new chemical optic device perfected by Max Teuber.

* * *

Is Another Ice Age Possible?

If the saying that history repeats itself is true, the United States should soon be visited by an ice sheet similar to those of prehistoric times. A prominent scientific authority on geographical subjects will discuss this subject clearly. In this article you will see an imaginative drawing, depicting the appearance of New York City buried under a mile thick sheet of ice.

* * *

How the Outdoors Is Brought Into the Studio

Motion picture directors and producers have always been noted for their ability to make the audience see something that was not actually photographed. This article will deal with effects that seemingly were taken in the open, but in reality were reproduced in the studio.

* * *

Aerial Taxicab at 20c a Mile

In the near future you may be able to call a taxicab, be transported to a flying field and there board an aerial taxicab which will transport you to or near your destination at the figure mentioned above. The new planes that make this possible will be described in detail.

* * *

Due to the lack of available space, the article dealing with Sun Dials which was mentioned in this column in our last issue must be held over until a future date.

* * *

The above are just a few of the treats in store for our readers in the next issue.

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EDITORIAL & GENERAL OFFICES: 53 Park Place, New York City

Published by Experimenter Publishing Company, Inc.
(H. Gernsback, Pres.; S. Gernsback, Treas.; R. W. DeMott, Sec'y).

Publishers of SCIENCE & INVENTION, RADIO NEWS, THE EXPERIMENTER and MOTOR CAMPER & TOURIST.

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SCIENCE AND INVENTION is published on the 10th of each month. There are 12 numbers per year. Subscription price is $2.50 a year in U. S. and possessions. Canada and foreign countries $3.00 a year. U. S. coin as well as U. S. stamps accepted (no foreign coin or stamps). Single copies, 25 cents each. A sample copy will be sent gratis on request.
All communications and contributions to this journal should be addressed to Editor, SCIENCE AND INVENTION, 53 Park Place, New York City, N. Y. Unaccepted contributions cannot be returned unless full postage has been included. ALL accepted contributions are paid for on publication.
SCIENCE AND INVENTION. Monthly. Application as second class matter made at New York, N. Y. with additional entry at Long Island City, N. Y. Post Office, under act of Congress of March 3, 1879. formerly entered at Jamaica, N. Y. Entered on Sept. 15, 1924, at Post Office, Atlanta, Ga., Chicago, Ill., Los Angeles, Cal., San Francisco, Cal. Title Registered at the Patent Office. Copyright, 1925, by E. P. Co., Inc., New York. The Contents of this Magazine are copyrighted and must not be reproduced without giving full credit to the publication. SCIENCE AND INVENTION is for sale at all newsstands in the United States and Canada; also at Brentano's, 37 Avenue de l'Opera, Paris. Member of the Audit Bureau of Circulations.

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Western Advertising Representatives Finucan & McClure 720 Cass St., Chicago, Ill.
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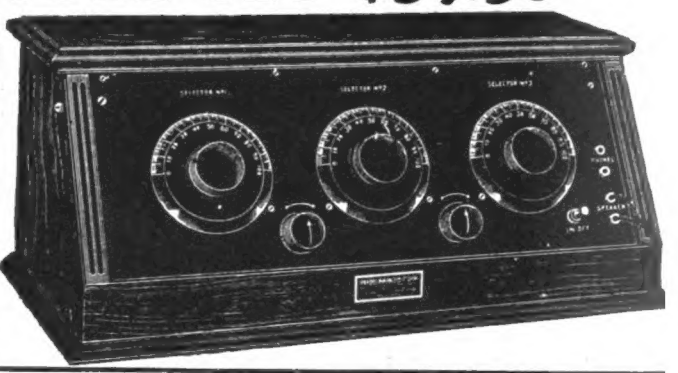
THIS 5-TUBE SET $39.50

FULLY BUILT AND WIRED COMPLETE IN DARK HEAVY MAHOGANY CABINET OF BEAUTIFUL DESIGN



The Biggest 5-Tube Value on the Market

which will bring in all distant stations on the loud speaker in clear loud tones. A value of three times the price. Shipped on a guarantee of satisfaction or money back. A wonder set constructed on the new principle that requires no neutralizers and is self-balanced. Special features are low-loss coils, engraved bakelite panel, distortionless transformers and pure bakelite sockets. Wiring of the latest loose safety type. Perfect logging of stations. The set alone, shipped prepaid, is..... **$39.50**

This Set with All Accessories, Including American Bell Loud Speaker, with

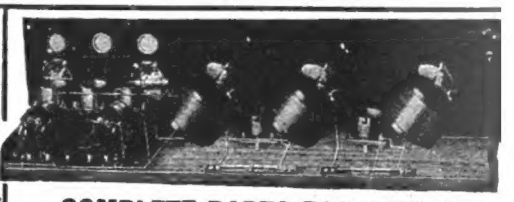
adjustable unit, 5 R.C.A. UV201-A Tubes, 2 45-volt "B" batteries, 1 6-volt 90 amp. hour storage battery, complete antenna equipment, including approved lightning arrester, shipped prepaid, east of the Rocky Mountains..... **$81.30**

COMPLETE PARTS FOR

ACME 1-Tube REFLEX..... **$17.45**

ACME 4-Tube REFLEX..... **$39.85**

with Genuine Acme parts as specified, drilled bakelite panel and full wiring diagram.



COMPLETE PARTS FOR 8-TUBE

SUPER-HETERODYNE

2 23-Plate Duplex or Laboratory Type Low Loss Condensers
3 Remler or Columbia Intermediate Frequency Transformers
1 Remler or Columbia Tuned Circuit Transformer
1 Special Oscillator Coupler
1 Midget Condenser
8 Bakelite Sockets
2 Thordarson or Columbia A. F. Transformers
1 Connecticut Filament Switch
2 Bakelite 6-ohm Rheostats
2 Bakelite 30-ohm Rheostats
1 Bakelite Potentiometer, 400 ohms
1 Carter Double Circuit Jack
1 Dubilier 1 mfd. Condenser
1 .006 Mica Condenser
1 .0005 Mica Condenser and 2 megohm Grid Leak
3 .0025 Mica Condensers
10 Binding Posts
1 .00025 Mica Condenser
1 Bakelite Terminal Strip for Binding Posts
1 Multicord Cable for connecting batteries
1 7x30x¼ Drilled Bakelite Panel
1 Baseboard
35 ft. Hook-up Wire
2 4-in. Bakelite Dials
2 4½-volt C Batteries

$59.75

Complete wiring diagrams, base board layout, blue-prints and instructions.

COMPLETE PARTS FOR 2-TUBE HARKNESS SET

including **Licensed Harkness Coils,** Drilled Panel and wiring diagram. Easy to build. Wonderful results..... **$17.95**

COMPLETE PARTS FOR REINARTZ

1-Tube Reinartz Set..... **$10.45**

3-Tube Reinartz Set..... **$17.55**

COMPLETE PARTS FOR 5-TUBE

NEUTRODYNE RECEIVING SET

Genuine Hazeltine Licensed Fada, or other Genuine Licensed Parts

1 7x24x¼ Drilled Panel
2 Thordarson or Columbia Audio Transformers
3 4-in. Bakelite Dials
2 Precision Jacks
1 Bakelite Rheostat, 30-ohm
1 Bakelite Rheostat, 6-ohm
1 Bakelite Binding Post Strip
7 Marked Binding Posts
1 Grid Leak and Condenser
5 Bakelite Sockets
1 .001 Condenser
1 .006 Mica Condenser
35 feet Hook-up Wire
1 Kit consisting of 3 Hazeltine Licensed Neutroformers and 2 Neutrodons
1 Baseboard
3 Bezels

$33.45

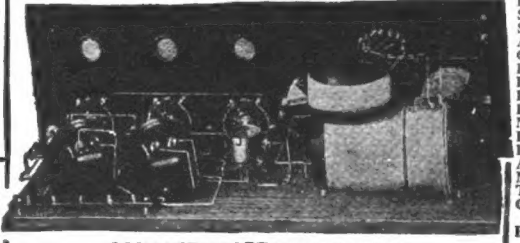
Complete blue-prints and working diagrams.

COMPLETE PARTS FOR 5-TUBE IMPROVED COCKADAY RECEIVING SET WITH RESISTANCE COUPLED AMPLIFICATION

As designed by L. M. Cockaday.

Including drilled panel and wiring diagram, complete, ready to wire.

$39.65



Easy to Build Your Own Radio Set

All complete parts for sets on this page consist of **standard advertised guaranteed parts** and include **drilled bakelite panels** and **wiring diagrams** for easy set construction.

Everything guaranteed on money-back basis. All transportation charges paid. **Don't forget!** Only genuine guaranteed parts used. Lack of space does not permit us to itemize individual parts, but you are fully protected by our money-back guarantee. **Our Service Division is behind you.**

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containing a thousand bargains of everything on radio—parts, supplies, complete parts for sets, complete sets, etc., also a mine of very latest information on all different circuits, complete list of broadcasting stations, and other valuable, up-to-the-minute radio data. Send your name and address on a card or letter. Also the names of a few friends. We will send catalog free.

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COMPLETE PARTS FOR 3-TUBE

COCKADAY RECEIVING SET

1 Cockaday Coil
2 23-Plate Hy-Grade Cond.
1 Bakelite Rheostat, 6-ohm
2 Bakelite Rheostat, 30-ohm
3 Bakelite Sockets
1 high ratio Columbia or Thordarson Transformer
1 Single Circuit Jack
1 low ratio Columbia or Thordarson Transformer
2 Double Circuit Jacks
2 3-in. Bakelite Dials
1 Grid Leak and Mica Cond.
7 Switch Points. 2 Stops.
1 Bakelite Binding Post Strip
7 Binding Posts
1 7x21x¼ in. Drilled Bakelite Panel
3 Bezels
1 Baseboard
1 Switch Lever
24-ft. Hoop-up Wire

$18.55

Complete blue-prints and wiring diagrams. **$10.10**

1-Tube Set

Genuine Radio Corporation Tubes UV201-A, UV199, WD12 or WD11	$ 3.55
Home Charger, 6-volt	12.95
Soldering Iron	.95
Solderall Tube	.19
Approved Lightning Arrester	.35
Cockaday Coils	1.59
Balancing Condensers, per pr.	.59
Harkness Coils, per set	1.95
Hydrometer, Best Quality	.44
Battery Meters, 0 to 50 volts	.89
Magnavox, M4, Loud Speaker	20.95
Baldwin Loud Speaker	21.45
Brandes Table Talker	8.45
Atlas Loud Speaker	21.95
Multiple Four Phone Plug	.89
Two Phone Plug	.24
Complete Antenna Outfit, including Lightning Arrester	2.59
Bakelite Moulded Variometer	3.25

Low Loss Condensers:		Accuratune Dials	$3.14
11-plate	$1.85	Audio Transformers	
23-plate	2.05	Thordarson:	
43-plate	2.85	3½ to 1	$3.25
Bakelite Rheostats:		6 to 1	3.65
6-ohm	$0.35	Acme	1.95
30-ohm	.38	Columbia:	
Amperites:		3½ to 1	$3.79
For all tubes	$0.94	6 to 1	3.89
Bakelite Dials:		American Bell:	
2-inch	$0.26	3½ to 1	$2.45
3-inch	.35	6 to 1	2.79
4-inch	.48	Randolph Special:	
Composition Dials:		3½ to 1	$1.89
2-inch	$0.13	6 to 1	2.19
3-inch	.17	Randolph Special Headphones	$2.24
4-inch	.29		

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Just write the names of the products about which you want information, and to avoid error the addresses of the manufacturers, on the coupon below and mail it to us.

If the advertiser requires any money or stamps to be sent to pay the mailing charges on his catalogue or descriptive literature, please be sure to enclose the correct amount with the coupon.

We will transmit to the various advertisers your request for information on their products.

This service will appear regularly every month on this same page in SCIENCE and INVENTION.

If there is any Manufacturer not advertising in this month's issue of SCIENCE and INVENTION from whom you would like to receive literature, write his name, address and the product in the special section of the coupon below.

TEAR ALONG THIS LINE

READERS' SERVICE BUREAU, S&I 3-25

Experimenter Publishing Co., Inc., 53 Park Place, New York, N. Y.

Please advise the firms listed below that I would like to receive detailed information on their product as advertised in the ..... issue of SCIENCE and INVENTION.

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NAME	ADDRESS	

Your own name here.....

If you are a dealer check here. ☐

Address.....

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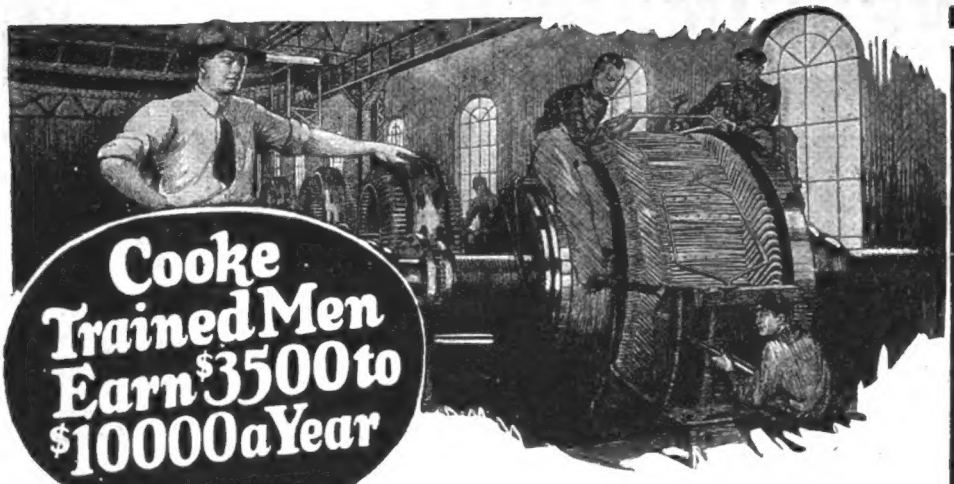


Cooke Trained Men Earn $3500 to $10000 a Year

Electricity Needs You I Will Train You at Home

L. L. COOKE, Chief Engineer

GET INTO ELECTRICITY. The world's biggest and most fascinating business needs you. Ordinary electricians earn $8 to $10 a day, but thousands of the biggest jobs—the ones that pay $12 to $30 a day—are going begging for want of *trained* men to fill them. Why stick to your small-pay, no-future job? In a few short months time with my training you can be an Electrical Expert earning $70 to $200 a week and not work half so hard as you do now.

Why Trained Electrical Men Are Needed

Thousands of new power stations — millions of automobiles — the wildfire spread of Radio and an undreamed of demand for electric light and power—all these things demand more and more trained men. The industry will be sadly crippled without these men — they must be had at any cost. That's why salaries are high and why they will stay high in Electricity.

I Can Train You Best

I am an engineer with college training and 20 years of practical experience. I have employed and directed the work of thousands of electrical men. I know what a man needs, to be a big success in Electricity. That's what I give you in my course—20 years of practical experience simplified, and made easy for you to understand. My Course is the recognized best and most successful training of its kind in America

JOBS—How I Get Them For My Students

I am spending over $25,000 a year to get jobs for my students. This money is actually spent on Employment Service alone. And I do get jobs for my students, even before they finish my course. They don't have to wait until they graduate. It is easy for me to do this because employers of electrical help know that "Cooke" Trained Men KNOW Electricity. They know that "Cooke" Trained Men are the best men they can get.

My 16 Big Guarantees

I don't promise you anything—I Guarantee it with a signed bond backed up by a Million Dollar Institution. It says, "you get your money back if you are not satisfied." There are no strings to this guarantee—you alone are the judge. Among the things I guarantee besides Free Employment Service are—use of my big Laboratory—Accomodations when you visit Chicago—Lifetime subscription to monthly Engineering Magazine—Consultation and Vocational Service—a big outfit of Tools and Apparatus—all FREE. Most of these things are exclusive with my training—you can't get them anywhere else.

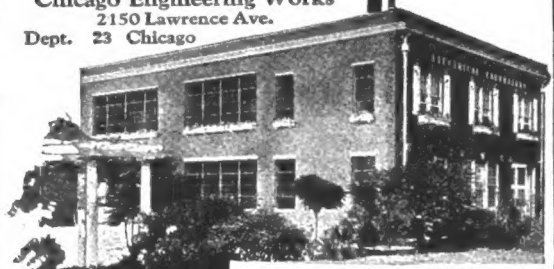
Investigate! Get the Proof! Big Electrical Book FREE

You want proof! You want facts! These I give you in my big book—The "Vital Facts" about Electricity—Proof that opportunities more wonderful than you ever dreamed of await you — Proof that "Cooke" Trained Men do get the big jobs in Electricity and that I can do more for you than anyone else. Send for my book now. Be a "Cooke" Trained Electrical Expert—Earn $70 to $200 a week. Mail the coupon NOW!

L. L. COOKE, *Chief Engineer*
Chicago Engineering Works
2150 Lawrence Ave.
Dept. 23 Chicago

Earn Extra Money While Learning

You can turn my training into money quick. In a few weeks after you enroll for my course I show you where and how to get spare time electrical work and teach you how to do it. I give you a complete outfit of tools and apparatus to work with. My training pays for itself many times over, even while you are learning. Hundreds of my students earn $25 to $35 a week in their spare time, while they are getting ready for a big job — all without loosing a single hour from their regular work.



Home of the Chicago Engineering Works, the Million Dollar Institution which backs up my guarantees.

Right, Above—The Electrical Laboratory.

Left, Below—The Administration Building.

My "Boys" Get the Big Jobs in Electricity

$800 to $1000 a Month for Jirinec

In business for himself doing Electrical work, John Jirinec, 1133 Fourth Avenue, Astoria, L. I., New York, makes over $10,000.00 a year. He says "Cooke" Training alone is responsible for his success.

Pence Earns Over $750 Every Month

W. E. Pence, Albany, Ore., specializes in Auto Electricity and makes $750.00 a month. Was formerly a mechanic earning $30.00 a week. Pence has the only "white collar" job in Automobile work. The repair man gets the grease and dirt—electrical experts get the money.

Montrose Makes $800 in 23 Days

Earl R. Montrose, Mono Lake, Calif., gets electrical contract, completes it in 23 days and collects $800.00 profit. Montrose says, "You not only taught me electricity, but you showed me also how to make money out of it."

Use My Money to Go Into Business For Yourself

Every month I start two of my students in business for themselves. I give them all the money they need, help them get started, and help them to a big success. Get the detail of this great offer—the greatest in history of home-study schools—from my big FREE book.

Mail this Coupon for my FREE BOOK

L. L. COOKE,
Chief Engineer,
Chicago Engineering Works,
Dept. 23 2150 Lawrence Ave., Chicago

Send me your book "The Vital Facts About Electricity," full particulars of your Home Study Course, and your 16 Guarantees, including your plan for helping me earn extra money while learning and details of your Free Employment Service. This does not obligate me to enroll for your Course.

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Address.....

City.....State.....

Occupation.....

The "Cooke" Trained Man is the "Big Pay" Man

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EXPERIMENTAL RADIO!

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By John L. Reinartz, 1QP, 1XAM.

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Experimental Flewelling Receiver
By Rufus T. Turner

The EXPERIMENTER Radio Data Sheets
By Sylvan H

The EXPERIMENTER Radio Data Sheets
By Sylvan Harris

for January, 1925
Two Tube Reflex Experiments
By Clyde J. Fitch

Experiments with Various Voltages on Standard Tubes
By L. W. Hatry

Measuring the Amplification Factor of a Vacuum Tube
By H. Diamond, Dept. of Electrical Engineering, Lehigh University

The Experimenter for D
Experimental Short-Wave Receivers
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The Experimenter for January, 1925
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12 Pages of EXPERIMENTAL RADIO

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Radio has tremendous possibilities for every experimenter. In fact it has been only by constant inventing and research work on the part of many engineers and designers that broadcasting has come into existence. Opportunity knocks at everyone's door *today*—Radio has a hundred problems waiting for you to solve.

The EXPERIMENTER, the one and only magazine expressly for the person who experiments, carries each month many pages of radio that detail the major problems of the industry that are waiting to be solved. The EXPERIMENTER covers completely the field of radio from the standpoint of the development of the industry.

A FEW TITLES OF THE RADIO ARTICLES IN PREVIOUS ISSUES OF THE EXPERIMENTER ARE SHOWN ON THIS PAGE.

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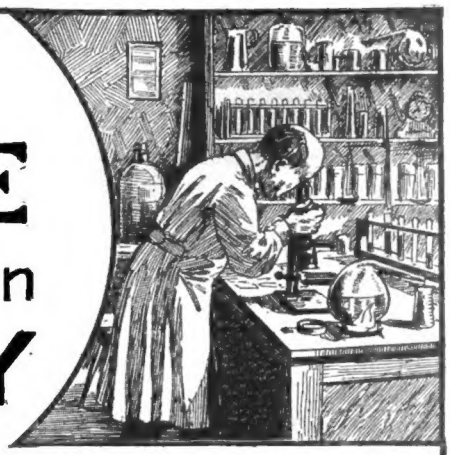
BURIED TREASURE can still be found in CHEMISTRY



Good Chemists Command High Salaries

and you can make yourself independent for life by unearthing one of chemistry's yet undiscovered secrets.

T. O'CONOR SLOANE, A.B., A.M., LL.D., Ph.D.
Noted Instructor, Lecturer and Author. Formerly Treasurer American Chemical Society and a practical chemist with many well known achievements to his credit. Not only has Dr. Sloane taught chemistry for years but he was for many years engaged in commercial chemistry work.

Do you remember how the tales of pirate gold used to fire your imagination and make you want to sail the uncharted seas in search of treasure and adventure? And then you would regret that such things were no longer done. But that is a mistake. They *are* done—today and everyday—not on desert islands, but in the chemical laboratories throughout your own country. Quietly, systematically, the chemist works. His work is difficult, but more adventurous than the blood-curdling deeds of the Spanish Main. Instead of meeting an early and violent death on some forgotten shore, he gathers wealth and honor through his invaluable contributions to humanity. Alfred Nobel, the Swedish chemist who invented dynamite, made so many millions that the income alone from his bequests provides five $40,000 prizes every year for the advancement of science and peace. C. M. Hall, the chemist who discovered how to manufacture aluminum made millions through this discovery. F. G. Cottrell, who devised a valuable process for recovering the waste from flue gases, James Gayley, who showed how to save enormous losses in steel manufacture, L. H. Baekeland, who invented Bakelite—these are only a few of the men to whom fortunes have come through their chemical achievements.

What Some of Our Students Say of This Course:

I have not written since I received the big set. I can still say that it far exceeded my anticipations. Since I have been studying with your school I have been appointed chemist for the Scranton Coal Co. testing all the coal and ash by proximate analysis. The lessons are helping me wonderfully, and the interesting way in which they are written makes me wait patiently for each lesson.—MORLAIS COUZENS.

I wish to express my appreciation of your prompt reply to my letter and to the recommendation to the General Electric Co. I intend to start the student engineering course at the works. This is somewhat along electrical lines, but the fact that I had a recommendation from a reliable school no doubt had considerable influence in helping me to secure the job.—H. VAN BENTHUYSEN.

So far I've been more than pleased with your course and am still doing nicely. I hope to be your honor graduate this year.—J. M. NORRUS, JR.

I find your course excellent and your instruction, truthfully, the clearest and best assembled I have ever taken, and yours is the fifth one I've studied.—JAMES J. KELLY.

From the time I was having Chemistry it has never been thus explained to me as it is now. I am recommending you highly to my friends, and urging them to become members of such an organization.—CHARLES BENJAMIN.

I shall always recommend your school to my friends and let them know how simple your lessons are.—C. J. AMDAHL.

I am more than pleased. You dig right in from the start. I am going to get somewhere with this course. I am so glad that I found you.—A. A. CAMERON.

I use your lessons constantly as I find it more thorough than most text books I can secure.—WM. H. TIBBS.

Thanking you for your lessons, which I find not only clear and concise, but wonderfully interesting. I am—ROBT. H. TRAYLOR.

I received employment in the Consolidated Gas. Co. I appreciate very much the good service of the school when a recommendation was asked for.—JOS. DECKER.

Now Is the Time to Study Chemistry

Not only are there boundless opportunities for amassing wealth in Chemistry, but the profession affords congenial employment at good salaries to hundreds of thousands who merely follow out its present applications. These applications are innumerable, touching intimately every business and every product in the world. The work of the chemist can hardly be called work at all. It is the keenest and most enjoyable kind of pleasure. The days in a chemical laboratory are filled with thrilling and delightful experimentation, with the alluring prospect of a discovery that may spell Fortune always at hand to spur your enthusiasm.

You Can Learn at Home

To qualify for this remarkable calling requires elaborate specialized training. Formerly it was necessary to attend a university for several years to acquire that training, but thanks to our highly perfected and thorough system of instruction, you can now stay at home, keep your position, and let us educate you in Chemistry during your spare time. Even with only common schooling you can take our course and equip yourself for immediate practical work in a chemical laboratory. Dr. Sloane gives every one of his students the same careful, personal supervision that made him celebrated throughout his long career as a college professor. Your instruction from the very beginning is made interesting and practical, and we supply you with apparatus and chemicals for performing the fascinating analyses and experimental work that plays such a large part in our method of teaching, and you are awarded the Institute's official diploma after you have satisfactorily completed the course.

Experimental Equipment Furnished to Every Student

We give to every student without additional charge this chemical equipment, including forty-nine pieces of laboratory apparatus and supplies, and forty different chemicals and reagents. These comprise the apparatus and chemicals used for the experimental work of the course. The fitted heavy wooden box serves not only as a case for the outfit but also as a useful laboratory accessory for performing countless experiments.

Easy Monthly Payments

You don't have to have even the small price of the course to start. You can pay for it in small monthly amounts—so small that you won't feel them. The cost of our course is very low, and includes everything, even the chemistry outfit—there are no extras to buy with our course. Our plan of monthly payments places a chemical education within the reach of everyone. Write us and let us explain our plan in full—give us the opportunity of showing you how you can qualify for a highly trained technical position without even giving up your present employment.

Special 30 Day Offer

Besides furnishing the student with his Experimental Equipment, we are making an additional special offer for a short while only. You owe it to yourself to find out about it. Write today for full information and free book "Opportunities for Chemists." Send the coupon right now while it is fresh in your mind. Or just write your name and address on a postal and mail it to us. But whatever you do, act today before this offer is withdrawn.

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New York 100

By H. W.

A GREAT metropolitan city like New York will of course grow to an unbelievable proportion in a century, or even half that time, and the pictures herewith will help to convey some idea as to how experts believe the foremost city of America will expand in the future. At the left we have an interesting perspective picture of "little old New York" at the dawn of the nineteenth century, when the population comprised about 60,000 people, a city about one-half the size of Paterson, or Trenton, N. J., today. New York in that day, 1800, extended northward about a mile from the Battery or southernmost point of Manhattan Island, as shown in the picture. The rest of Manhattan Island was occupied by farms, while ships from Europe and other parts of the world were beginning to find this a thriving sea-port. The positions of the principal bridges of today, as well as Central Park, are indicated by the dotted lines.

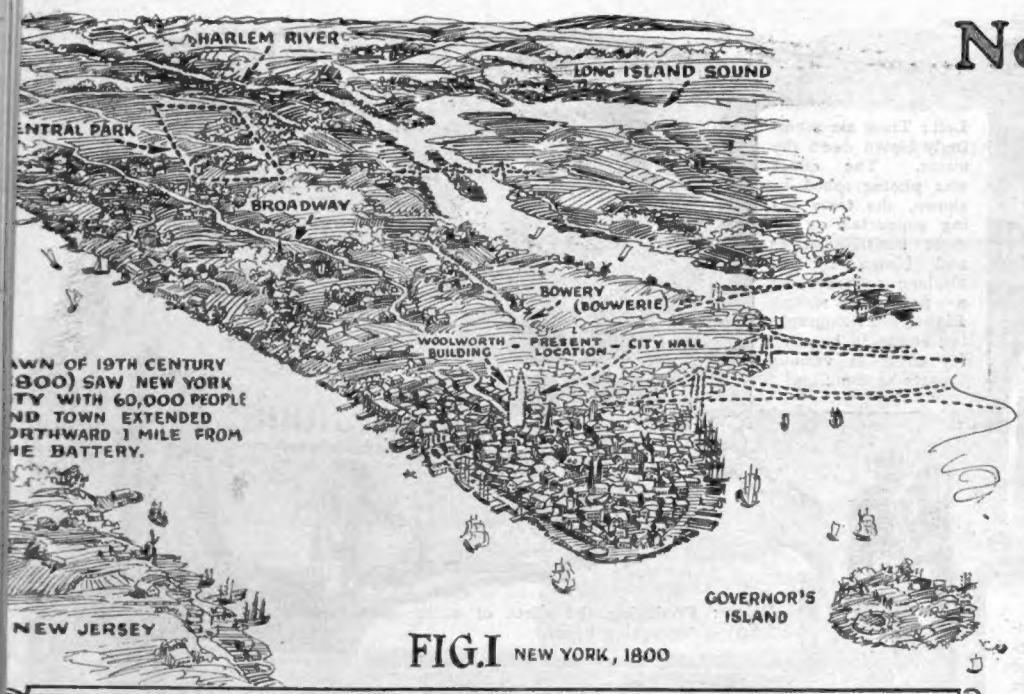

FIG. I NEW YORK, 1800

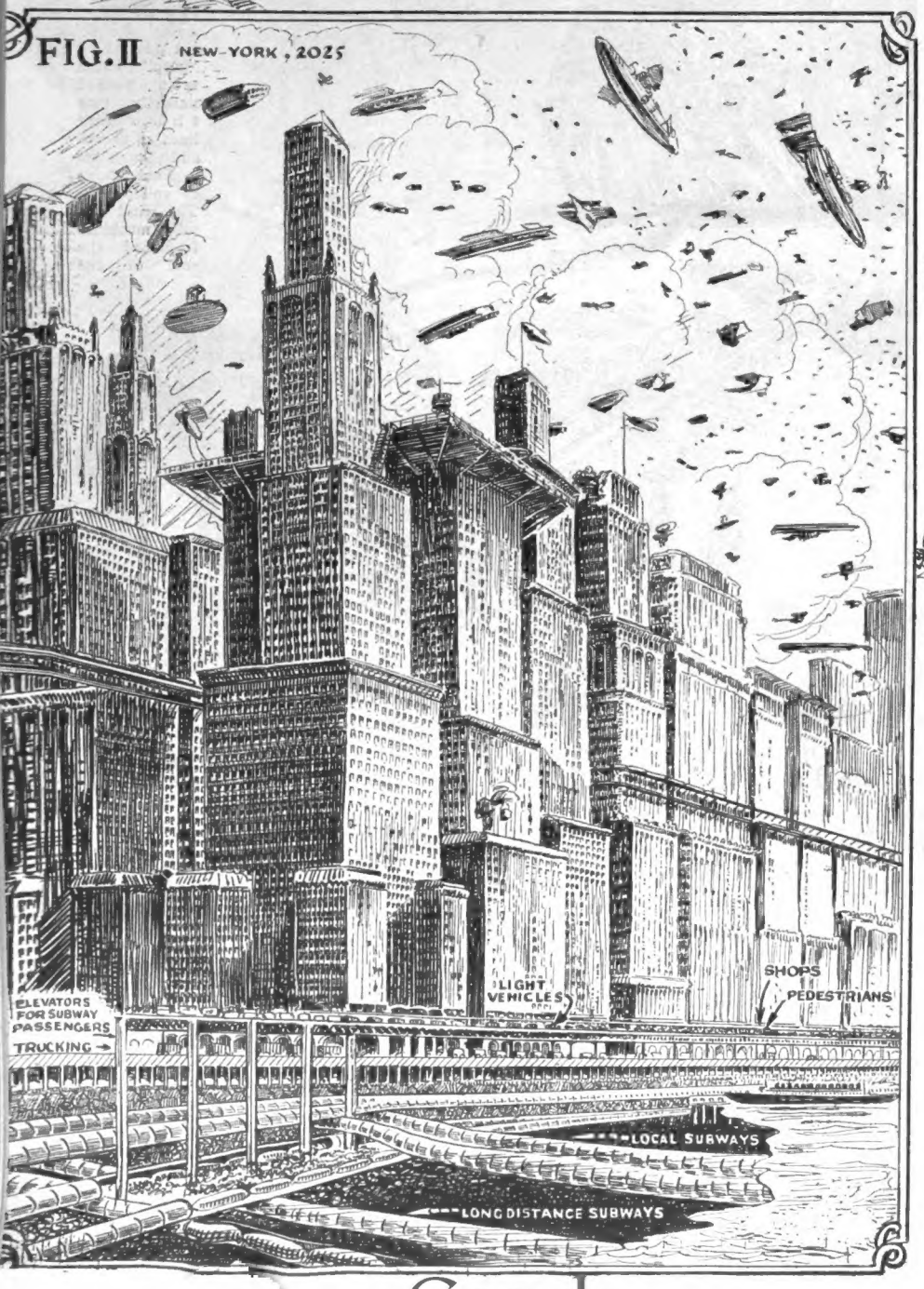

FIG. II NEW-YORK, 2025

IN the illustration, Fig. 2, at left, we gain a good idea of the probable appearance of New York's skyscrapers in the year 2025, or a century hence. Other large cities will of course have similar tall buildings without a doubt, as well as numerous underground subways and triple as well as quadrupled-decked streets. The lower level of future city streets will be occupied by motor trucks, while the level above this will be occupied by lighter vehicles, such as pleasure cars. The sidewalks, some moving type, in the next twenty-five to fifty years, will doubtless be built above the motor vehicle street level and be arranged inside of arcades within the buildings themselves. This will not only enclose the sidewalks at least overhead, as an insurance against rain and snow, but this arrangement will provide much better show window display facilities for stores. In twenty-five years we of this generation will doubtless see the sky filled with aircraft.

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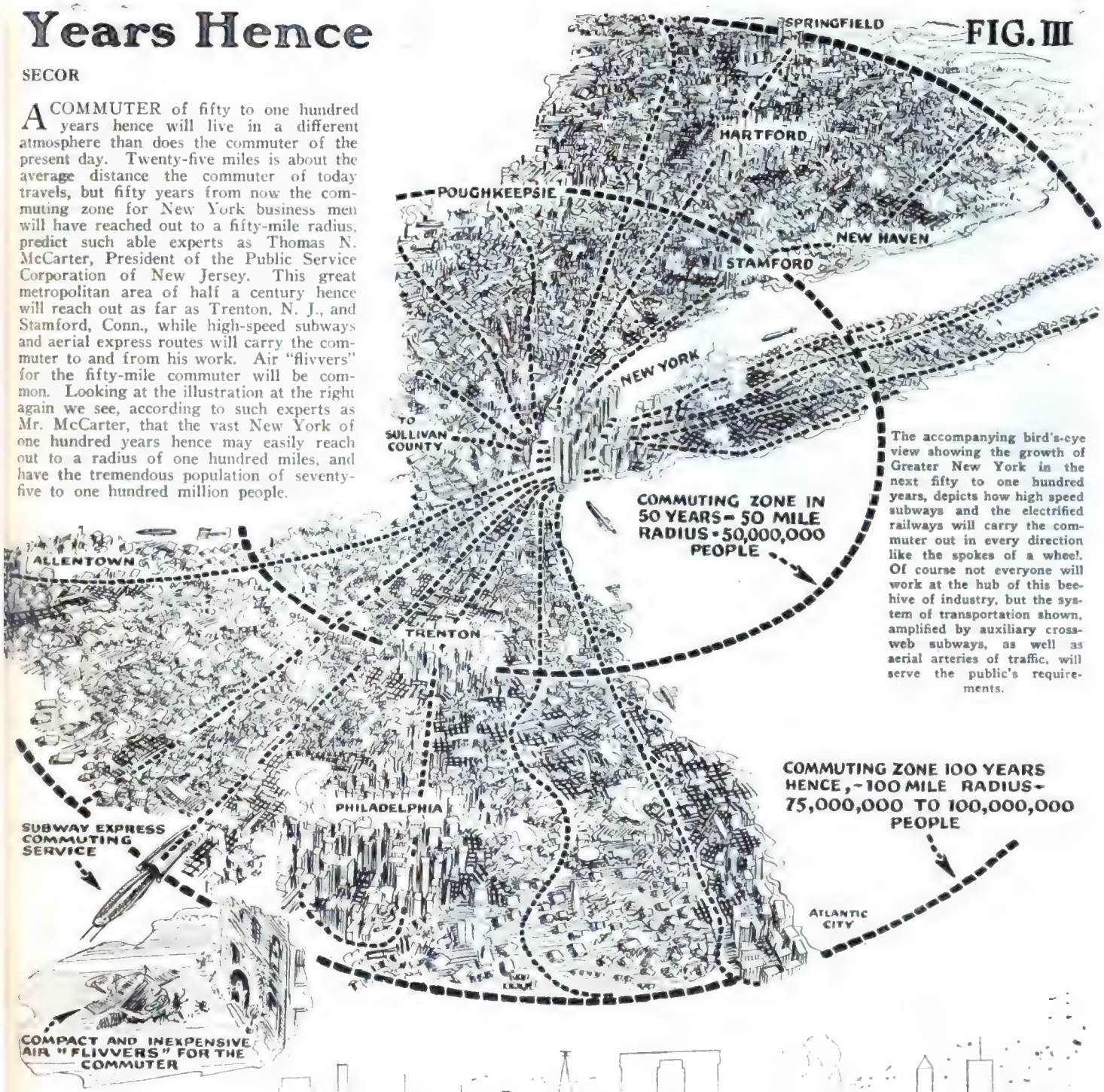
Years Hence

SECOR

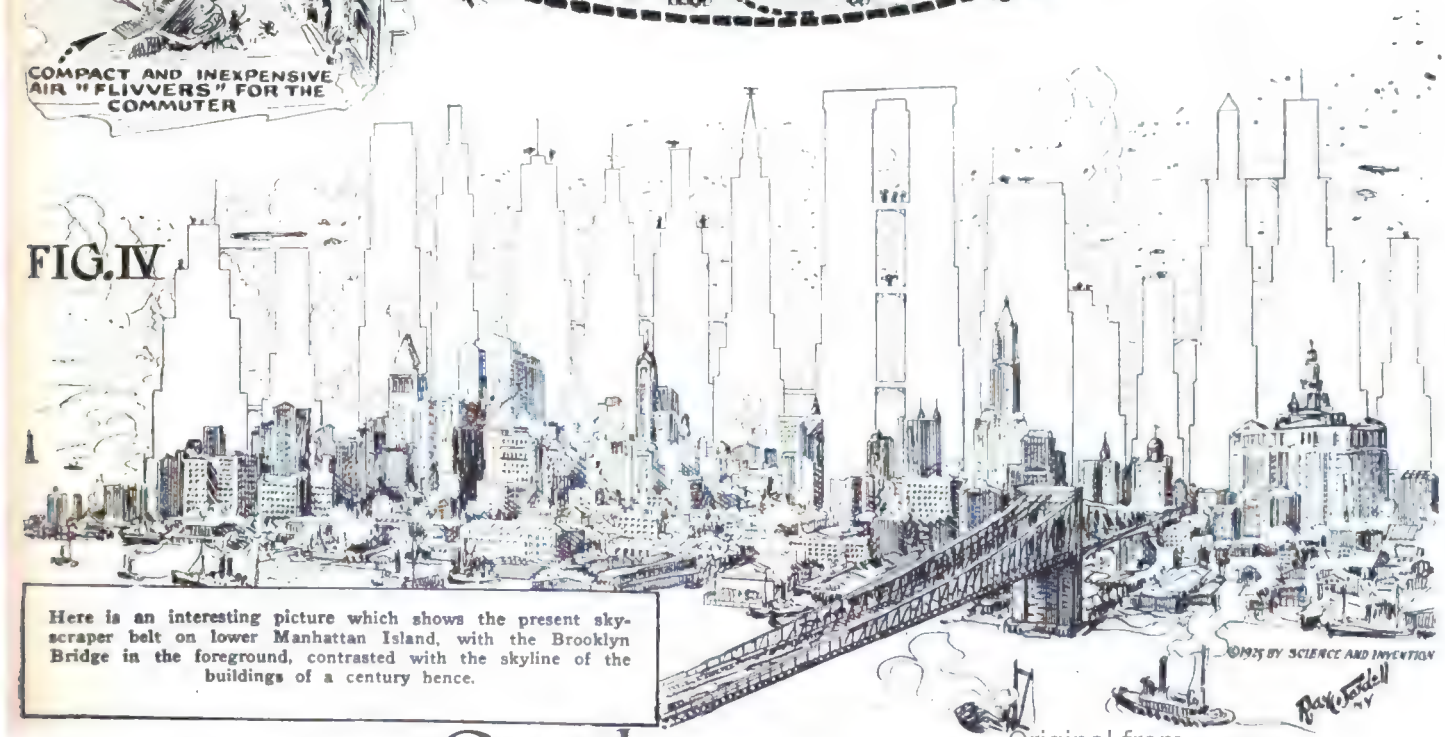
A COMMUTER of fifty to one hundred years hence will live in a different atmosphere than does the commuter of the present day. Twenty-five miles is about the average distance the commuter of today travels, but fifty years from now the commuting zone for New York business men will have reached out to a fifty-mile radius, predict such able experts as Thomas N. McCarter, President of the Public Service Corporation of New Jersey. This great metropolitan area of half a century hence will reach out as far as Trenton, N. J., and Stamford, Conn., while high-speed subways and aerial express routes will carry the commuter to and from his work. Air "flivvers" for the fifty-mile commuter will be common. Looking at the illustration at the right again we see, according to such experts as Mr. McCarter, that the vast New York of one hundred years hence may easily reach out to a radius of one hundred miles, and have the tremendous population of seventy-five to one hundred million people.

FIG. III



The accompanying bird's-eye view showing the growth of Greater New York in the next fifty to one hundred years, depicts how high speed subways and the electrified railways will carry the commuter out in every direction like the spokes of a wheel. Of course not everyone will work at the hub of this beehive of industry, but the system of transportation shown, amplified by auxiliary cross-web subways, as well as aerial arteries of traffic, will serve the public's requirements.

FIG. IV



Here is an interesting picture which shows the present sky-scraper belt on lower Manhattan Island, with the Brooklyn Bridge in the foreground, contrasted with the skyline of the buildings of a century hence.

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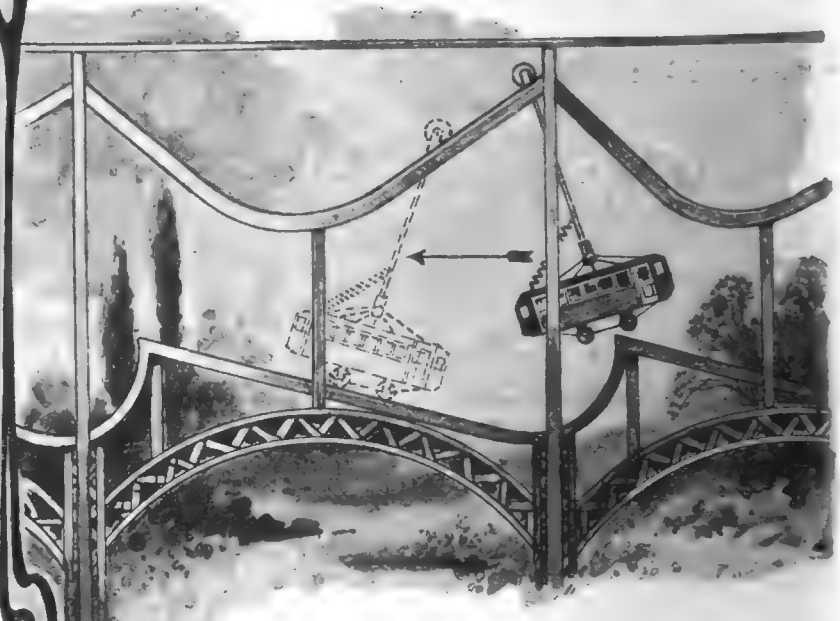
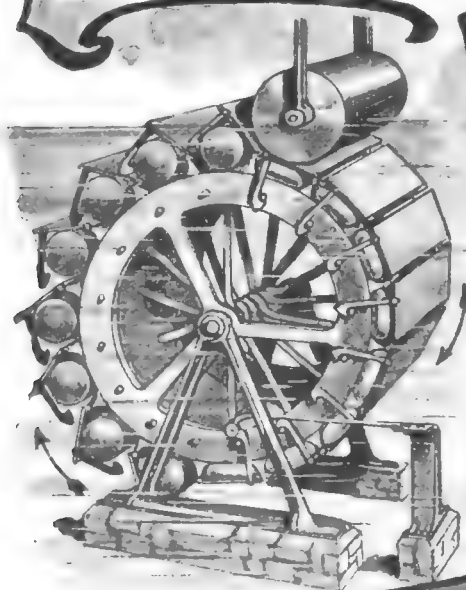
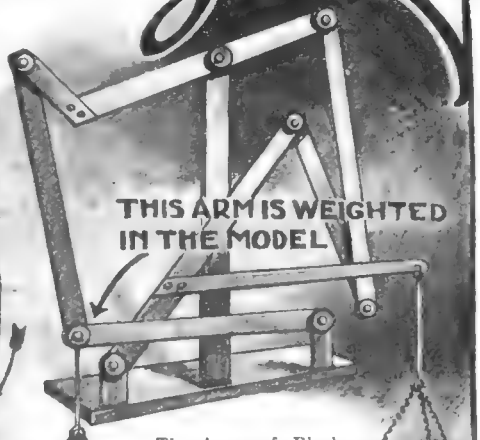
The Perpetual —$5,000

By JOSEPH

The perpetual motion machine illustrated above was built in England. Like all other similar devices, it did not work, and after spending years of fruitless energy in building it, its inventor disappeared, leaving the model behind. The machine resisted all efforts to turn it.

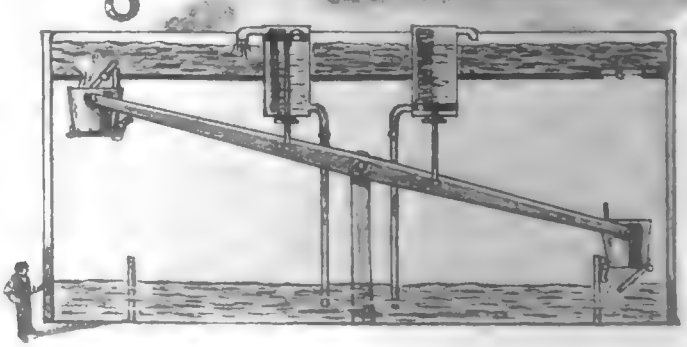






The hoax of Bluske of Asheville, N. C., above and a photo of model below and diagonally to the left. Bluske claims that a weight on one side of the pan will lift twice as much on the other side through the same arc. To make it do so, he weights one pan of the balance.

The machine above is submerged in water. The balloons on one side are inflated. A roller at the top forces the air from upper balloons to the bottom. Buoyancy of half the wheel makes it run. The device at the extreme right is another mechanism working on the water principle. Neither of the two are operative.



$5,000.00 IN PRIZES

As elusive as the quest for the pot of gold at the end of the rainbow is the search for perpetual motion. Machines working by natural forces such as winds, tides, temperature changes, etc., are not perpetual motion machines. By perpetual motion one means *a machine, which without assistance of any external force except gravity, shall keep on moving until its parts are worn out.* It is not necessary that the machine evolve more power than that which is required to run it. The mere fact that it continues to run would of itself be of great value. Perpetual motion inventors may be divided in two classes. First, those who are laboring under a delusion, developing absurd ideas, and second, those who are perpetrating deliberate frauds. The first group can sometimes be reasoned with; the second group "knew" that they have developed perpetual motion, but bring forth the logical (?) argument, "Why should I show anyone my perpetual motion machine actually working. They would steal the idea and I would get nothing for it." To this group SCIENCE AND INVENTION MAGAZINE says, "If you will bring or ship your working model of a perpetual motion machine to the offices of this publication, and if it is a perpetual motion machine coming under the classification above indicated, this publication will pay the sum of $5,000.00 and will give you publicity on the machine if you so desire for merely being permitted to watch the machine in operation. In order to conform with post office regulations, this offer is made to expire on March 1st, 1926. Further information concerning this award is found on the next page.

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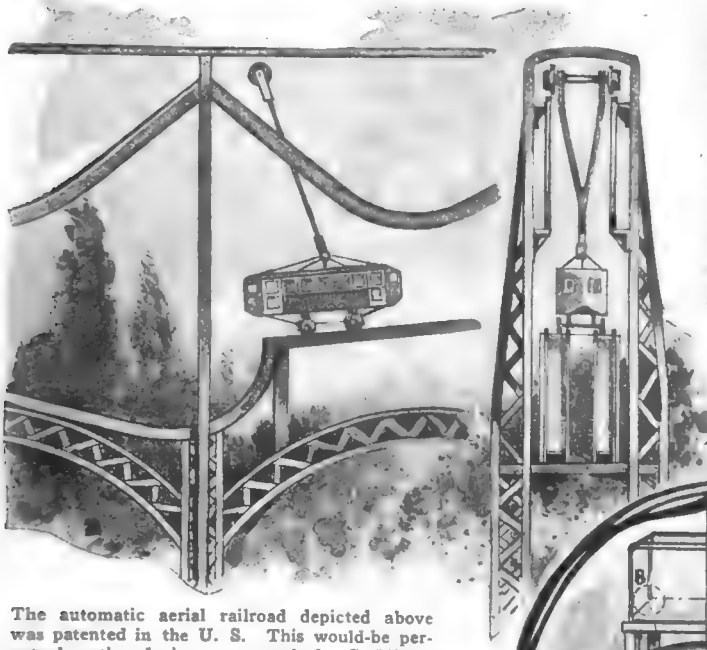
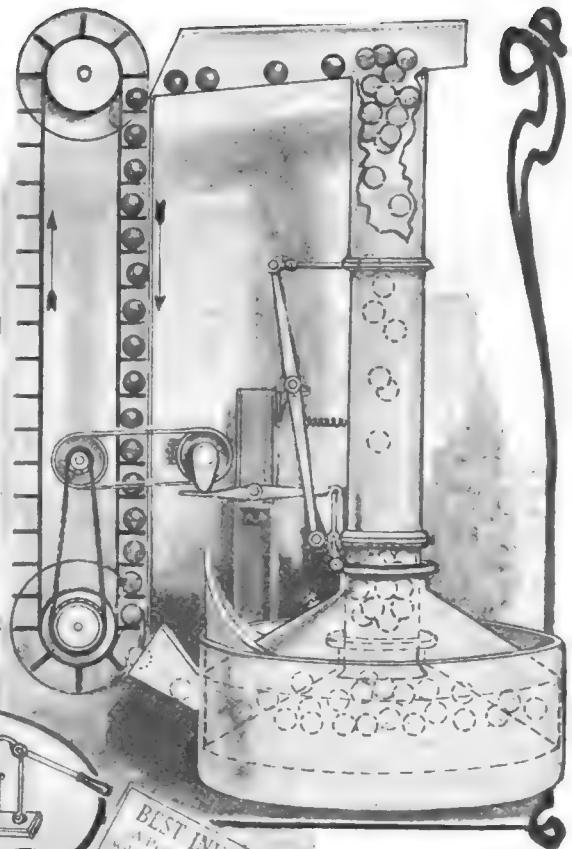
Motion Myth in Prizes

H. KRAUS

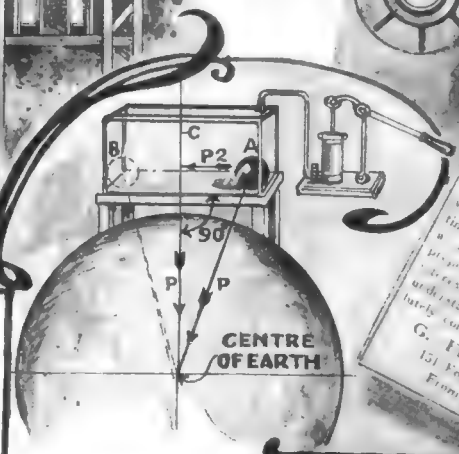


The automatic aerial railroad depicted above was patented in the U. S. This would-be perpetual motion device never worked.—G. Miller.

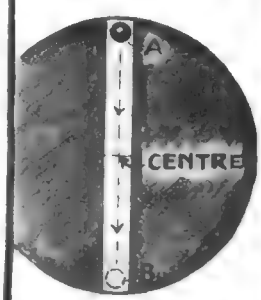
The railway at the left rolled down-hill When it gathered momentum the trolley at the top lifted the entire car to the top of the next incline. The mechanism at the right is supposed to operate by buoyancy and gravity. Balls floating on the surface of the water rise up the column of water, and descend on the endless belt. The cover rises and falls and the valves work automatically.



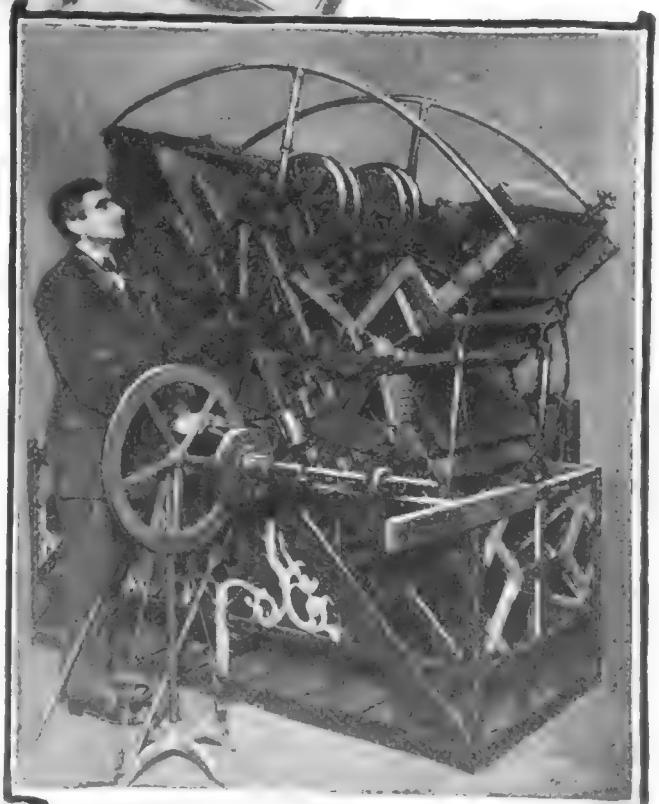
THE reason that SCIENCE AND INVENTION MAGAZINE is offering an award of $5,000.00 for a working model of a perpetual motion machine may be given in a few words. Throughout the country we see advertisements, placards, and postal cards advising the public to invest in means of developing perpetual power. Some of these advertisements are reproduced on these pages. Always the inventor claims to be the proud possessor of the one and only working perpetual motion machine. Invariably the inventor claims to be looking out for the investor's individual welfare. He does not want to give the system to the "crooked politicians" who are anxiously waiting to give him several hundred thousand dollars for his rights to the invention. He glibly paints a wonderful picture of the earning capacities of such an invention and zealously and covetously guards his secret. If he gets your ten cents or a hundred dollars for a share in the invention, he gloats over his success. The next time one of these inventors call to see you, show him a copy of this publication, tell him there are no strings tied to the offer. Tell him SCIENCE AND INVENTION does not want the rights to his invention. *They merely want to see it working*, and if it does so, they will praise it from the housetops and give it not $100.00, but $5.000.00. Should two or more contestants tie for this award, a duplicate prize will be paid to those so tying.



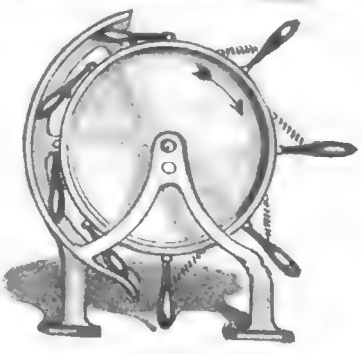
Left, a typical advertisement clipped from a newspaper proclaiming discovery of perpetual motion. We wonder how many fell for this?



The two perpetual motion systems illustrated above should work if all conditions are applied. First the surface of the plate will have to be perfectly plane and the ball perfectly spherical. There must be no air resistance nor friction between the ball and plate. When started the ball will oscillate back and forth. A ball dropped through the center of the earth would do likewise if there were no friction. Centrifugal force is not considered.—C. A. Oldroyd.



Mr. Ulram and his perpetual motion machine are shown above. He tells investors that when he has enough mercury he will make the machine work. He has admitted to the editors that there is something wrong with the machine.



The device at the right is a typical fallacy. The inventor believes that the weights at the right of the wheel being further from the center than those at the left, the wheel should continue to run. The only difficulty is that it will not do so. Note that there are five weights at the left.

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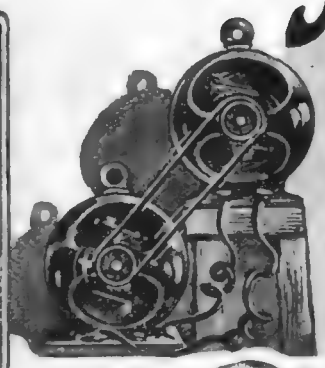
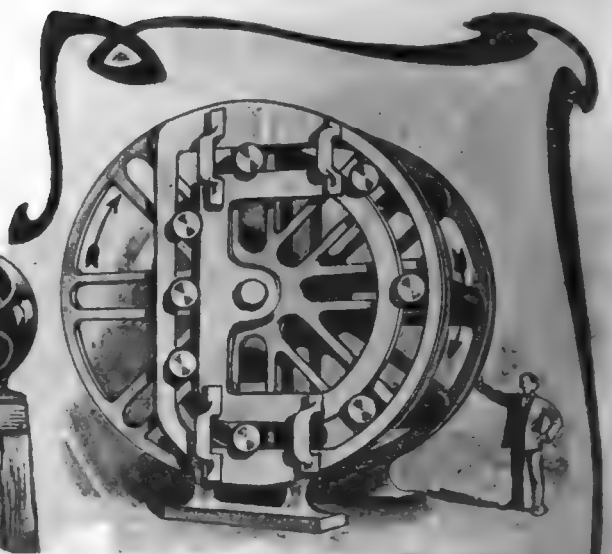
More Frauds

(Continued from preceding page)

The bicycle above was described in a London paper, the "Westminster Gazette." As the rider bounced along on it, air was compressed in a storage tank which operated the air turbine, and in turn the wheel (?)—result—more bounces and more speed?!X



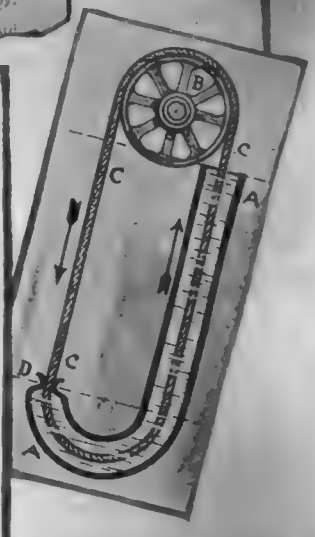


The weights further from the center on one side are supposed to cause the wheel to turn.

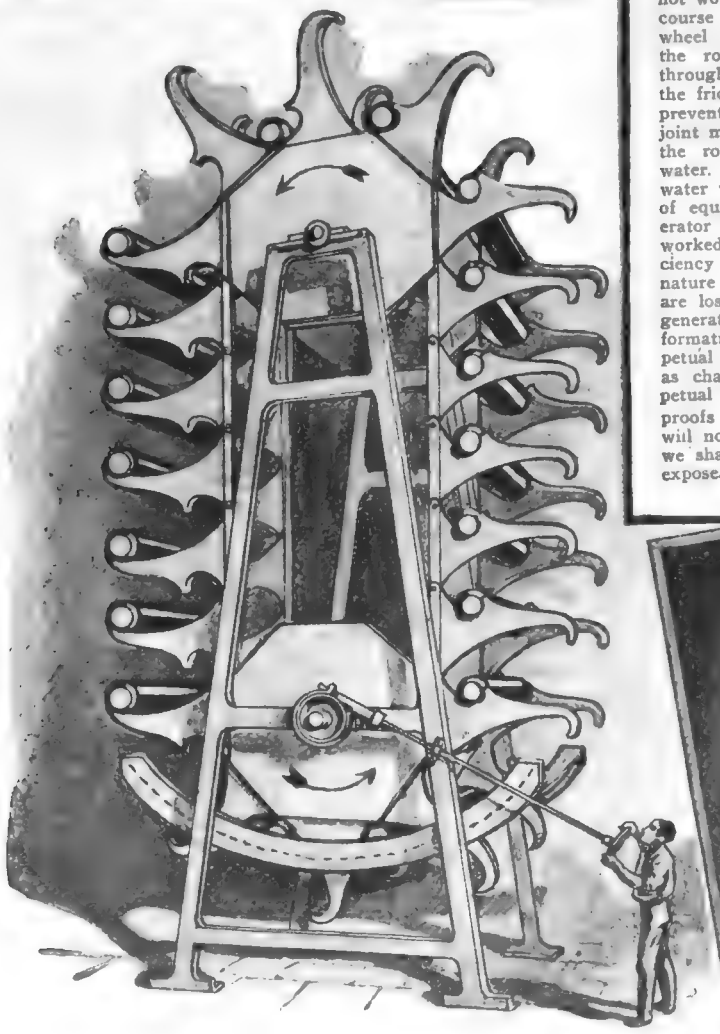
...igo, Ill. ...OR A METHOD, formula, process ... at will prevent freezing of asphaltic concrete. Offer expires ... 1925. Address: S. ... Hofheimer, Land Title Bldg., Philadelphia, Pa.

$500 FOR A SIMPLE DESIGN for a motor generator set or rotary converter, in which the motor obtains excitation from the generator it drives. Both offers expire May 1, 1925. Address: William H. Mitchell Co., Troy, Ohio. ...RNLAND ... 67th St. ... makes a monthly award ... and illustrated

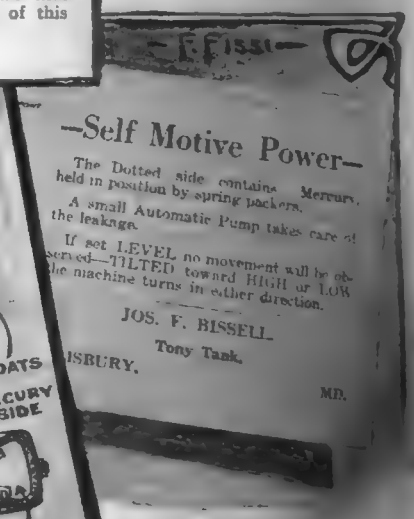
IN those devices where the weights are further from the center on one side of the wheel than on the other, there is always a preponderance of weight on the ascending side. The most that a device of this nature could do is to reach a state of stable equilibrium where of course it will not work. In the device at the right, one has of course friction in the bearings of the axle of the wheel B, power is required to bend and unbend the rope, and there is friction in passing it through the water, but the most serious of all is the friction at the point D. If the water is to be prevented from flowing out through D, then the joint must be so tight as to prevent movement of the rope or other buoyant body through the water. If this is not quite tight enough, the water will pour out of D until it reaches a state of equilibrium. Connecting the motor and generator together as indicated above, has never worked and never will operate, because the efficiency of two pieces of electrical apparatus of this nature can never be one hundred per cent. There are losses in transmission, in wiring, and in the generation of currents as well as in their transformation. We do not brand all seekers of perpetual motion as charlatans. We do brand those as charlatans who claim to have produced perpetual motion and who are unwilling to lay their proofs before the scientific world. This article will not close the discussion, and we realize that we shall receive many letters as a result of this expose.



Above A is a column of water. C is a buoyant rope. One side is thought lighter than the other, but friction at the point D prevents it from operating.



A patent has actually been taken out on the device above illustrated. The inventor does not state that the device is perpetual motion but this seems to be the claim. The mechanism is equipped with a brake to prevent it from going too fast, and in patent claims is provided with a motor to start it. WITHOUT A MOTOR IT CANNOT WORK.


—Self Motive Power—
The Dotted side contains Mercury, held in position by spring packers.
A small Automatic Pump takes care of the leakage.
If set LEVEL no movement will be observed—TILTED toward HIGH or LOW the machine turns in either direction.
JOS. F. BISSELL
Tony Tank.
ISBURY,
MD.

The mechanism above illustrated and the postcard describing another self-motive power machine. ...ury is supposedly held o... side of the machine by packing s... nd the other side is bu... The inventor does not consider th... n resulting from ... strips which are to hold the mercur... e. The device is inop...

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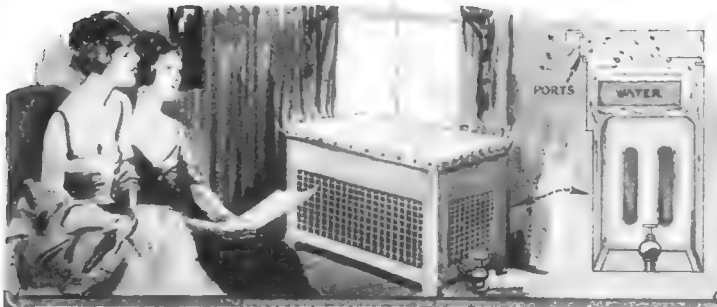
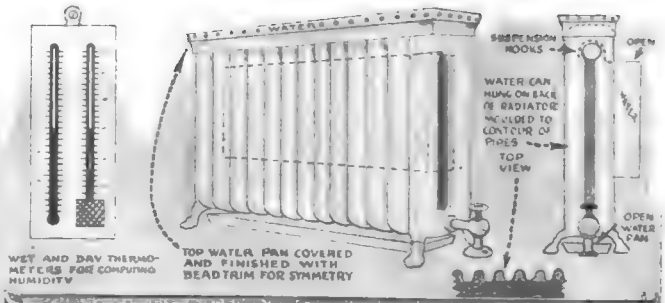
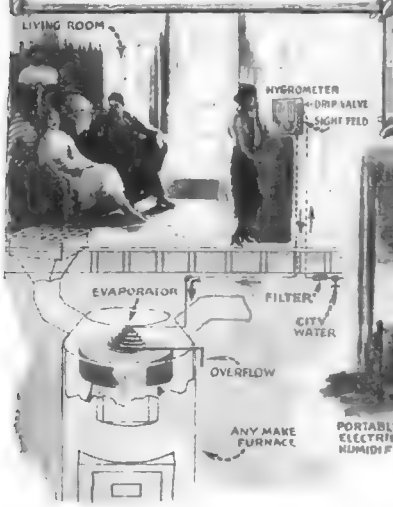
Improving the Heating System



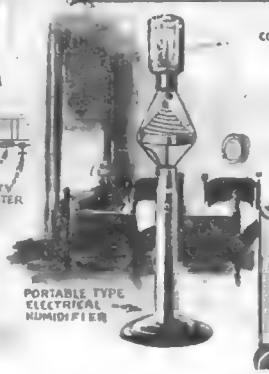
A decorative casing to be placed around radiators and to contain water for humidifying the air has recently been placed on the market. It is illustrated in perspective and cross-section.

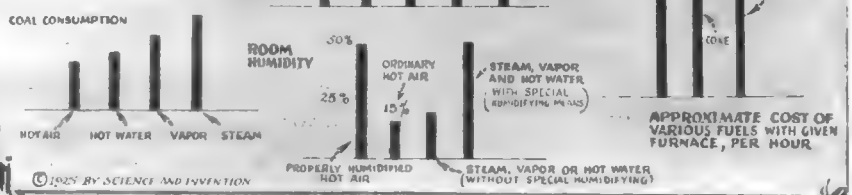

WET AND DRY THERMOMETERS FOR COMPUTING HUMIDITY
TOP WATER PAN COVERED AND FINISHED WITH BEAD TRIM FOR SYMMETRY
SUSPENSION HOOKS
WATER CAN HUNG ON BACK OF RADIATOR MOULDED TO CONTOUR OF PIPES
TOP VIEW
OPEN WATER PAN

A wet and dry thermometer aids in computing humidity. Right: Cans of water placed as shown will assist greatly in humidifying the air when heated by the radiator.



Lower left: New evaporator for humidifying air from hot air furnace. Below: Same device electrically operated.





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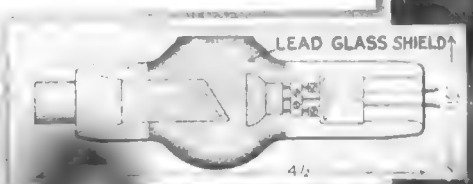
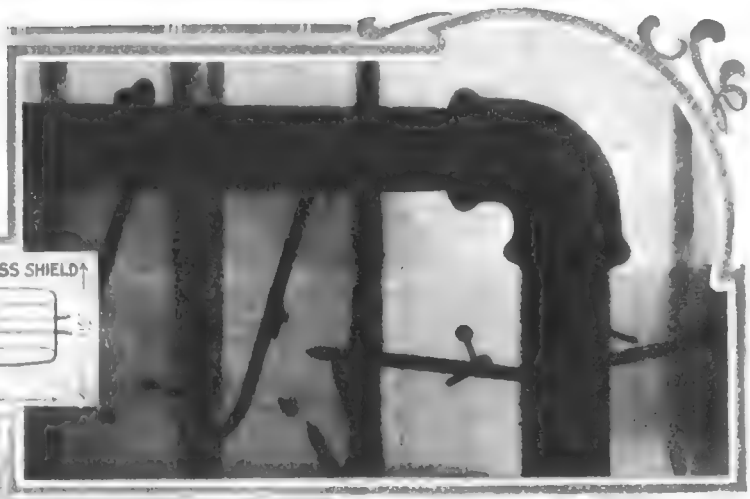
One of the greatest drawbacks to most of our modern heating systems is the fact that the air is not properly humidified and therefore is not conducive to good health. Some of the ideas herewith show how to rectify this. Above: Comparisons of initial cost, operating cost, coal consumption and humidity with various types of present day furnaces.—H. W. Secor.

High Power Portable X-Ray

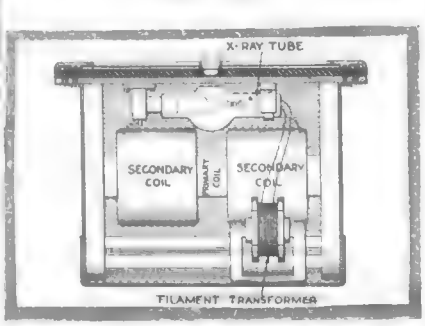
Portable X-ray outfit weighing 20 pounds is shown at left. It may be used for industrial purposes or by doctors and dentists. The type and size of tube used is shown below. Right: X-ray photograph through wall of house. Pipes, conduits and wires can thus be located.





Left: Locating pipes in wall. Above: Using portable X-ray outfit on dental patients. Special arm holds unit in place.

Below: A cross-sectional view of portable X-ray outfit. Tube and transformer which delivers 56,000 volts and operates on house current are immersed in oil. Special chamber provides for expansion of oil due to heat.



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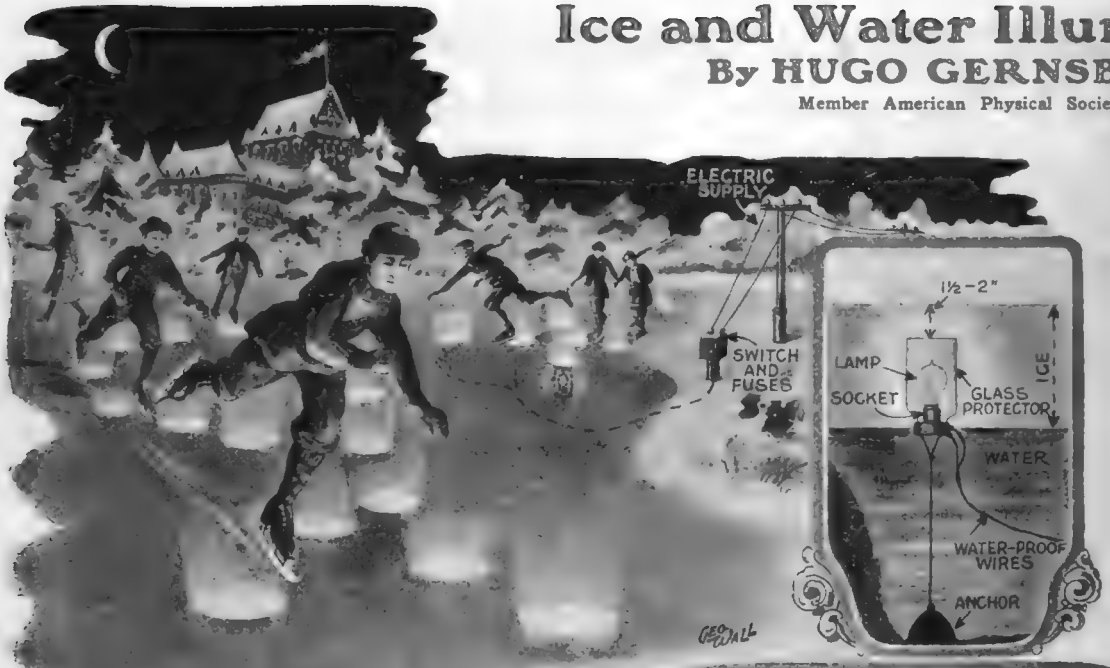
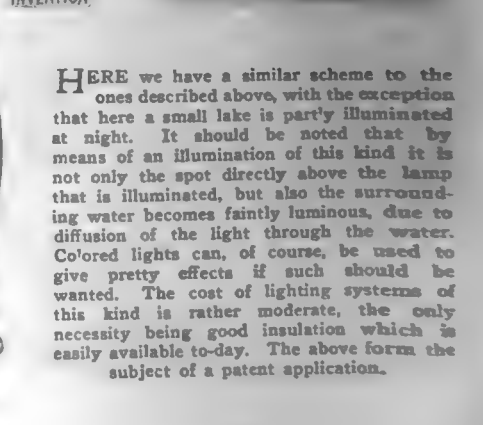
Ice and Water Illumination

By HUGO GERNSBACK
Member American Physical Society



THE writer presents a novel scheme for under-ice and under-water illumination. There are of course, outdoor skating rinks now in existence, on which lighting is provided by means of overhead electric lamps. The writer produces a novel and weird effect by lighting the ice by means of electric lamps suspended in the water in the manner shown in the small illustration. Each lamp has a glass protector, and the lamp is kept in place by means of an anchor. The glass protector also acts as a sort of heat insulation between the lamp and the ice, to keep it from melting. The lamps are about two inches below the surface of the water before the latter freezes. Once the water freezes it surrounds the electric lamp and, when turned on, it provides a weird and fascinating spectacle.

IN this view we see how a large steamer is guided by means of an under-water system of the same class as the one used for the ice illumination explained above. Channels, inlets, and other dangerously shallow bodies of water, can be marked by means of such electric lighting systems, which will guide the large steamer so that grounding the latter will become almost an impossibility.



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HERE we have a similar scheme to the ones described above, with the exception that here a small lake is partly illuminated at night. It should be noted that by means of an illumination of this kind it is not only the spot directly above the lamp that is illuminated, but also the surrounding water becomes faintly luminous, due to diffusion of the light through the water. Colored lights can, of course, be used to give pretty effects if such should be wanted. The cost of lighting systems of this kind is rather moderate, the only necessity being good insulation which is easily available to-day. The above form the subject of a patent application.

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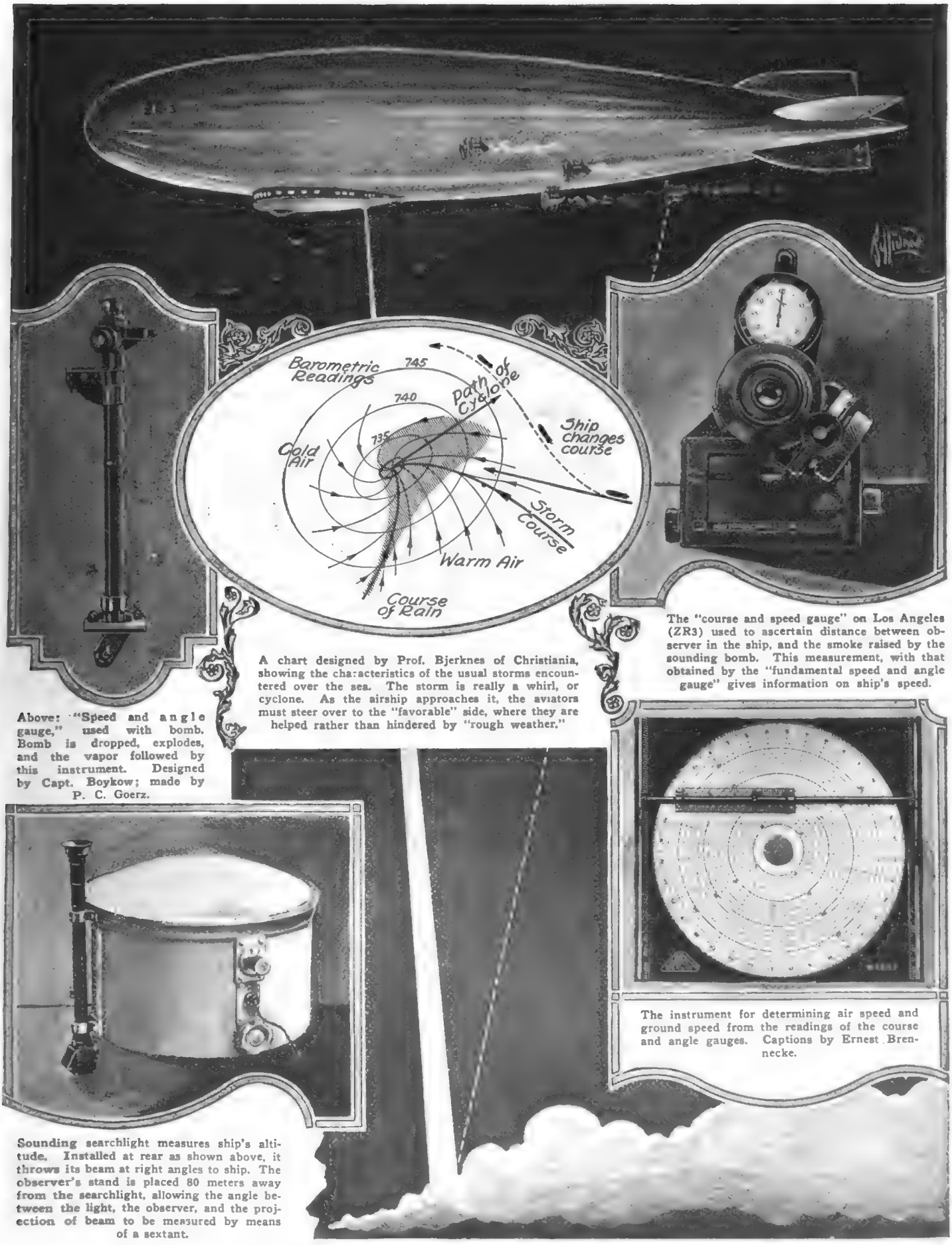
Navigation Instruments on "Los Angeles"

By DR. ALFRED GRADENWITZ



A chart designed by Prof. Bjerknes of Christiania, showing the characteristics of the usual storms encountered over the sea. The storm is really a whirl, or cyclone. As the airship approaches it, the aviators must steer over to the "favorable" side, where they are helped rather than hindered by "rough weather."

The "course and speed gauge" on Los Angeles (ZR3) used to ascertain distance between observer in the ship, and the smoke raised by the sounding bomb. This measurement, with that obtained by the "fundamental speed and angle gauge" gives information on ship's speed.

Above: "Speed and angle gauge," used with bomb. Bomb is dropped, explodes, and the vapor followed by this instrument. Designed by Capt. Boykow; made by P. C. Goerz.

The instrument for determining air speed and ground speed from the readings of the course and angle gauges. Captions by Ernest Brennecke.

Sounding searchlight measures ship's altitude. Installed at rear as shown above, it throws its beam at right angles to ship. The observer's stand is placed 80 meters away from the searchlight, allowing the angle between the light, the observer, and the projection of beam to be measured by means of a sextant.

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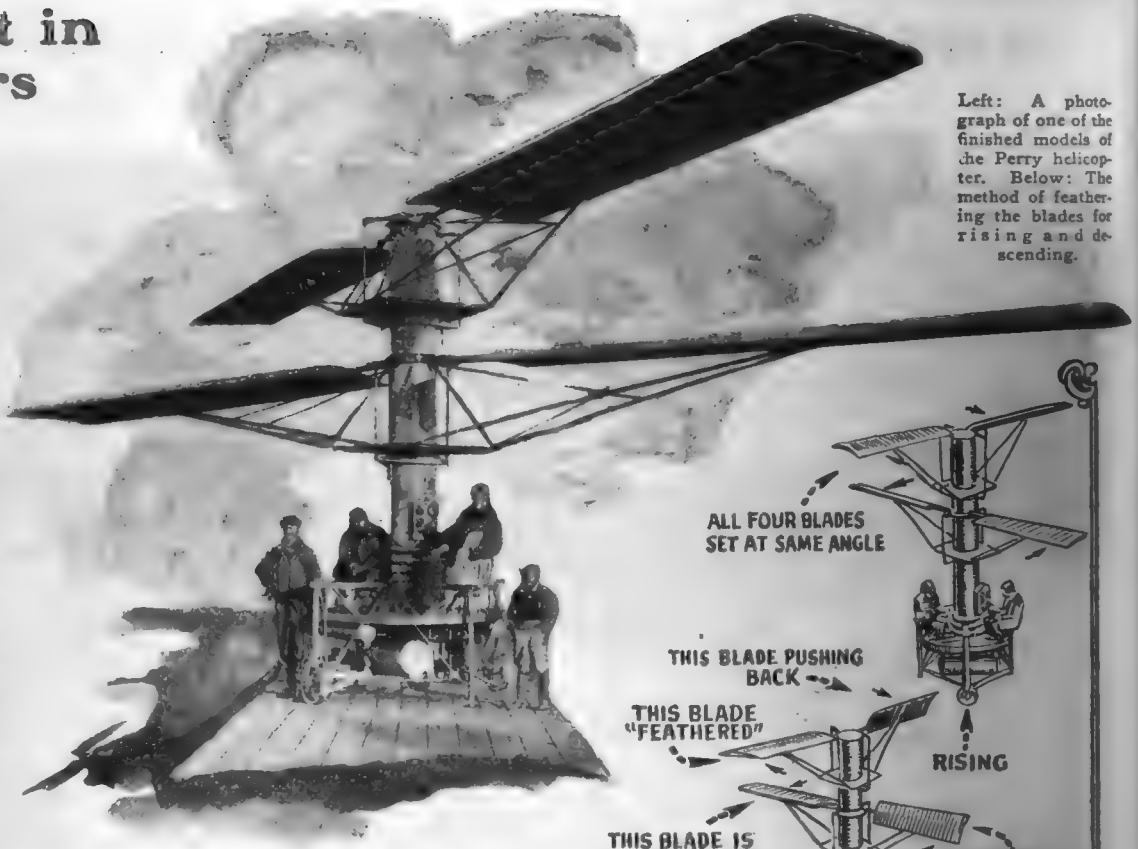
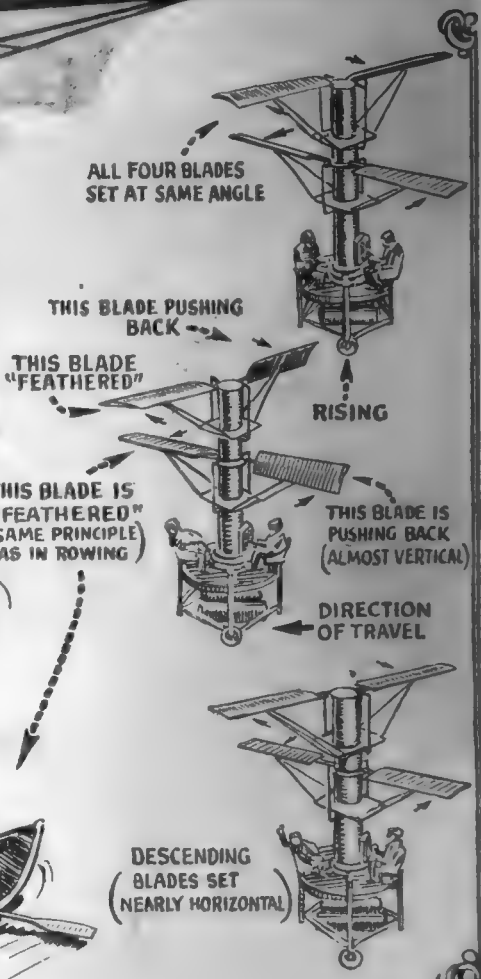
The Latest in Helicopters

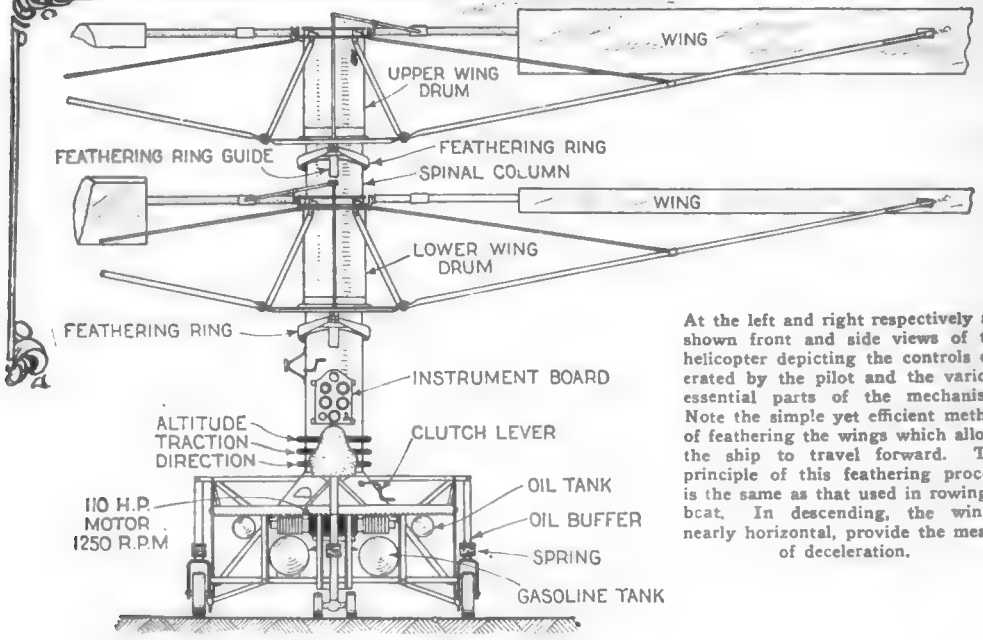
ALTHOUGH helicopters have been considered to be rather out of the question in the field of practical aeronautics up to the present time there have been many experimental models of such devices built. The most notable and one of the latest of these is the Perry helicopter designed by Thomas O. Perry, backed by Chicago Helicopters, Ltd., for entry in the British World-Wide Helicopter Competition and illustrated here. In essence, the device may be described as follows: A one hundred and ten horse-power rotary engine drives two sets of wing panels or aerofoils, each four feet wide by eighteen feet long. The ship is sixteen feet high and weighs about 2,200 pounds without fuel, oil or crew. Controls are so arranged and designed that the angles or tilt of the wings can be controlled equally or when desired each wing can be controlled individually. Automatic arrangements allow the blades, when it is necessary, to be "feathered" as illustrated.



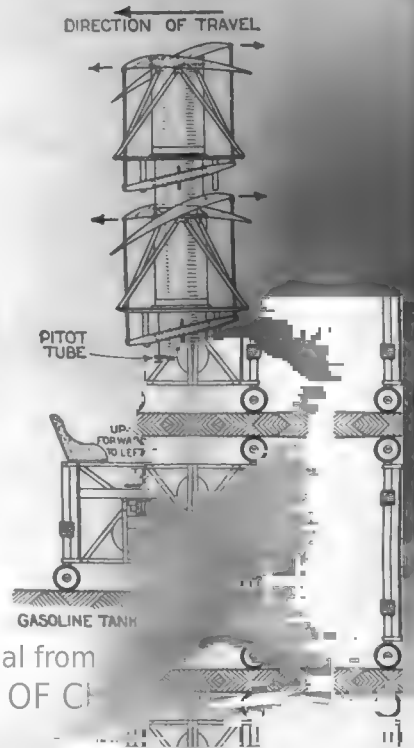
Left: A photograph of one of the finished models of the Perry helicopter. Below: The method of feathering the blades for rising and descending.


ALL FOUR BLADES SET AT SAME ANGLE
THIS BLADE PUSHING BACK
THIS BLADE "FEATHERED"
RISING
THIS BLADE IS "FEATHERED" (SAME PRINCIPLE AS IN ROWING
THIS BLADE IS PUSHING BACK (ALMOST VERTICAL)
DIRECTION OF TRAVEL
DESCENDING BLADES SET (NEARLY HORIZONTAL)

Above: The Perry helicopter ready for one of its test flights, with the cabin around the occupants removed.



At the left and right respectively are shown front and side views of the helicopter depicting the controls operated by the pilot and the various essential parts of the mechanism. Note the simple yet efficient method of feathering the wings which allows the ship to travel forward. The principle of this feathering process is the same as that used in rowing a boat. In descending, the wings, nearly horizontal, provide the means of deceleration.



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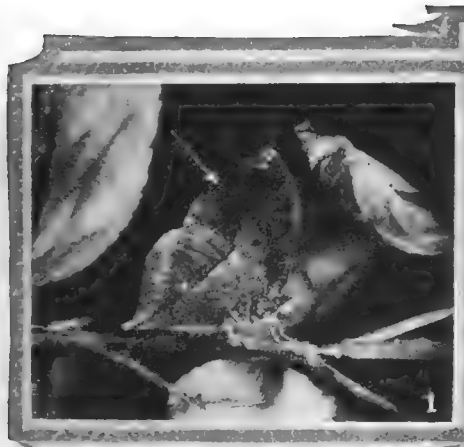
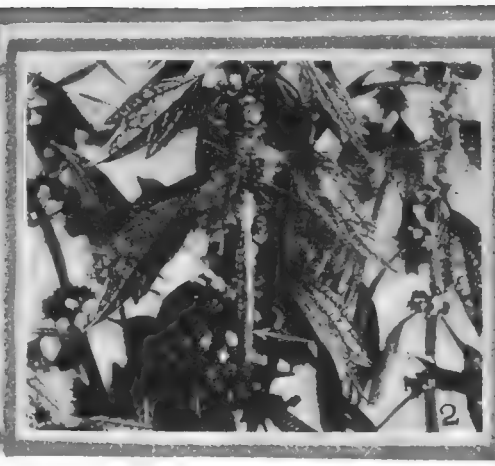
Animals Which Become Invisible

By DR. ERNEST BADE





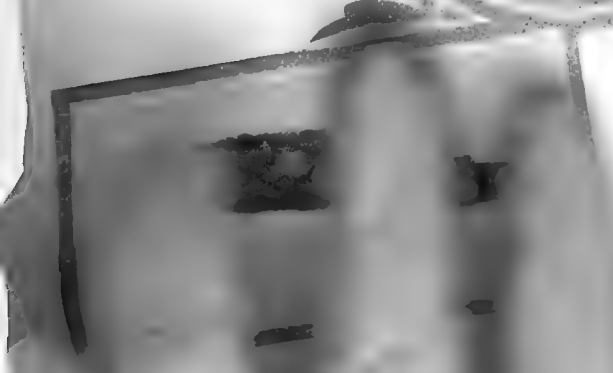
NATURE seems to play tricks, for many animals know how to make themselves invisible. Just see the butterfly, No. 1 which resembles a dry leaf; even the middle vein is imitated. Next to it, No. 2, is darning needle at rest. Its colored, slender body is pressed next to the stem and its wings, which are as transparent as glass, can hardly be seen.

And not only are the insects and the smaller animals provided with protection of this nature as there are hundreds of other examples to be found in every locality. Witness the snow rabbit of the northern countries which is practically invisible on expanses of snow, his fur blending perfectly with the background. Probably the most striking example of protective coloration is the zebra of the jungle countries whose stripes blend perfectly with the streamers of sunlight which filter through the trees.

Illustrations Nos. 3 and 6 depict a night moth which, strange to say, has two sets of wings, one of them brightly colored and the other of a dull coloration that serves as a protection. In No. 3, both sets of wings are shown, while in No. 6 the drab front wings cover and conceal the rear wings.

Above in No. 5 we show the hiding place of the spittle insect. The tiny animal is concealed beneath the froth which it has produced upon the grass and which protects the insect from enemies. A similar hiding place is shown in No. 7. Here is shown the white, waxey and hairlike substance with which the woolly apple louse covers itself for protection.

The insect known as the walking stick and which may be either green or brown is shown in No. 4. When feasting on the limbs of trees it resembles a twig so closely that it is thereby protected from enemies.



Among the fish of all the waters of the world we often find weaker creatures that cannot protect themselves against their more ferocious relations in a physical way and which must therefore resort to subterfuge. The flounder illustrated in No. 9 is an excellent example of this. Not only has the flounder the habit of changing its color to approximate that of the bottom of the sea where it happens to be, but it may further protect itself by digging into the sand as shown, until only the eyes and the mouth are visible.

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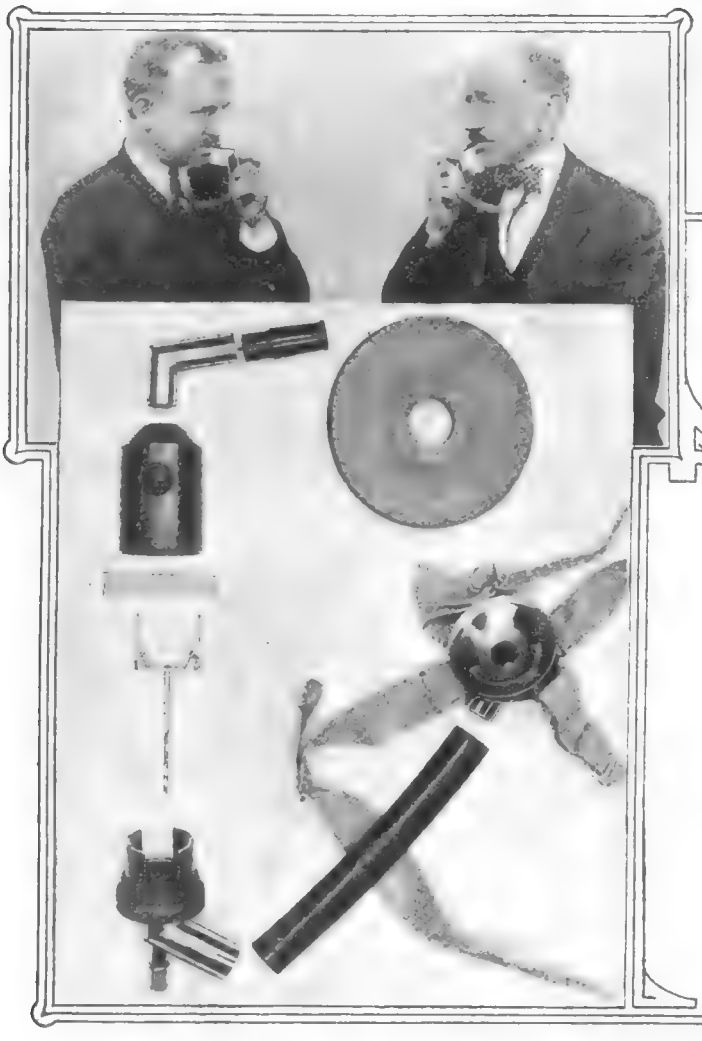
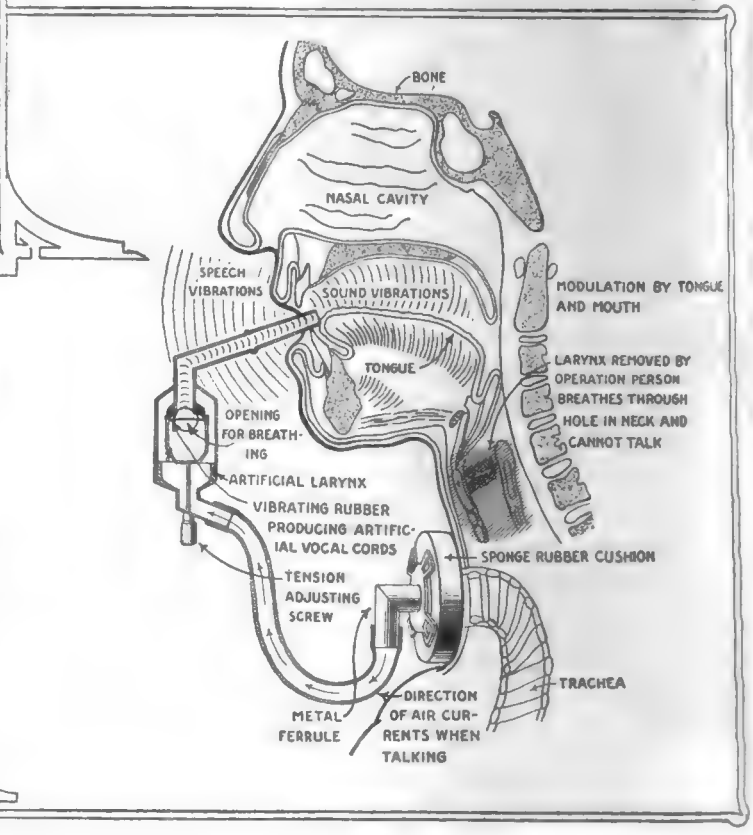
The Artificial Larynx

ONE of the most remarkable inventions of the year is the artificial external larynx or vocal chords. In those individuals upon whom an operation for cancer of the throat has been performed, the larynx is removed and the trachea opens at a hole at the lower part of the neck. Naturally, these people cannot speak because no air moves past the vocal chords and causes them to vibrate. Accordingly, Dr. McKintey and engineers of the Western Electric Company, Dr. Harvey Fletcher, Ph.D., and C. E. Lane, M.Sc., and R. L. Wengel, A.B., developed and demonstrated to us the artificial larynx illustrated below.

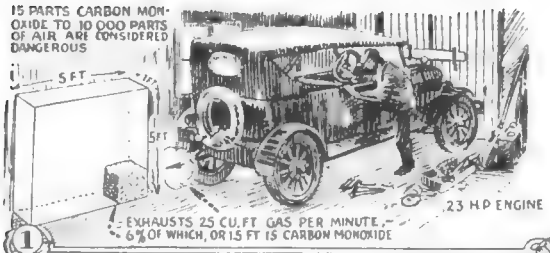




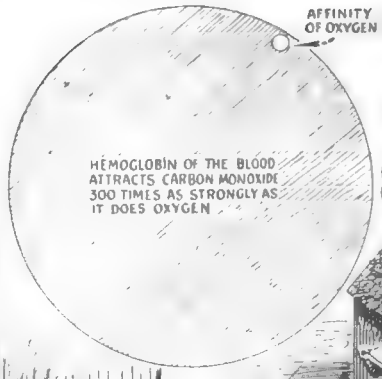
The above photo shows two patients using the artificial larynx and conversing with each other. The mode of action is as follows: By opening the air intake, air is inhaled into the lungs and on being forced out, it must pass into the mouth. In doing so it vibrates a small rubber diaphragm, producing a grunt-like sound. This sound is conveyed into the mouth by a sort of pipe stem where the shape of the mouth and the movements of the tongue and lips modulate the sound, producing clear audible speech. Many victims of cancer of the throat need no longer worry about losing their speech and will not wait until the last minute before they decide upon an operation. The instrument taken apart is illustrated in the photo at the left. Science is slowly but surely developing substitutes for diseased or exhausted human organs.

—J. Kay London.

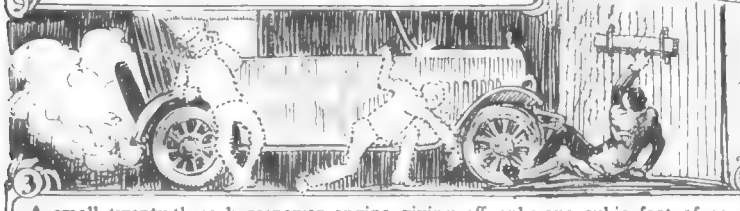
Deadly Carbon Monoxide


15 PARTS CARBON MONOXIDE TO 10 000 PARTS OF AIR ARE CONSIDERED DANGEROUS
5 FT
5FT
23 H.P. ENGINE
EXHAUSTS 25 CU.FT GAS PER MINUTE, 6% OF WHICH, OR 1.5 FT IS CARBON MONOXIDE

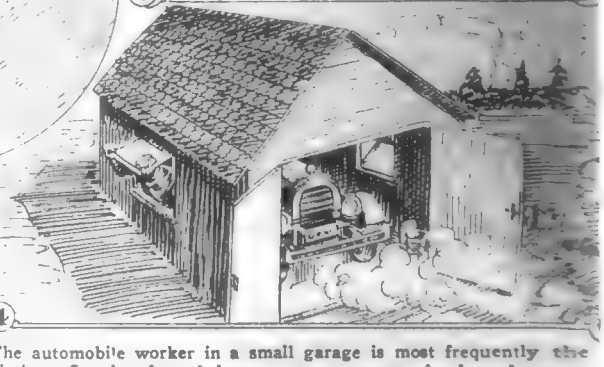
1 A small twenty-three horsepower automobile engine discharges twenty-five cubic feet of gas per minute containing six per cent. carbon monoxide, or one and a half cubic feet of the deadly gas. Fifteen parts carbon monoxide in 10,000 parts of air is dangerous.



2 Carbon monoxide is colorless, tasteless, and almost odorless. Its affinity for the hemoglobin in the red cells of the blood is about three hundred times as strong as for oxygen. The red corpuscles are thus prevented from giving up oxygen to the tissues, death resulting from paralysis of the respiratory apparatus.



3 A small twenty-three horsepower engine giving off only one cubic foot of carbon monoxide per minute, would contaminate the air of a small closed garage ten by twenty feet to the danger point, in three minutes. The attack comes on insidiously and consciousness is gradually lost.



4 The automobile worker in a small garage is most frequently the victim. It, therefore, behooves every person who intends running his engine in a small garage for even three minutes, to see to it that the windows and doors are wide open, and that the place itself receives proper ventilation. Better play safe!!

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What Happens In the X-Ray Tube

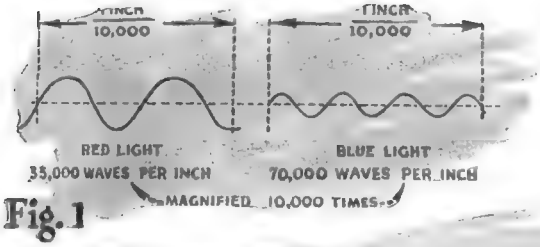


Fig. 1

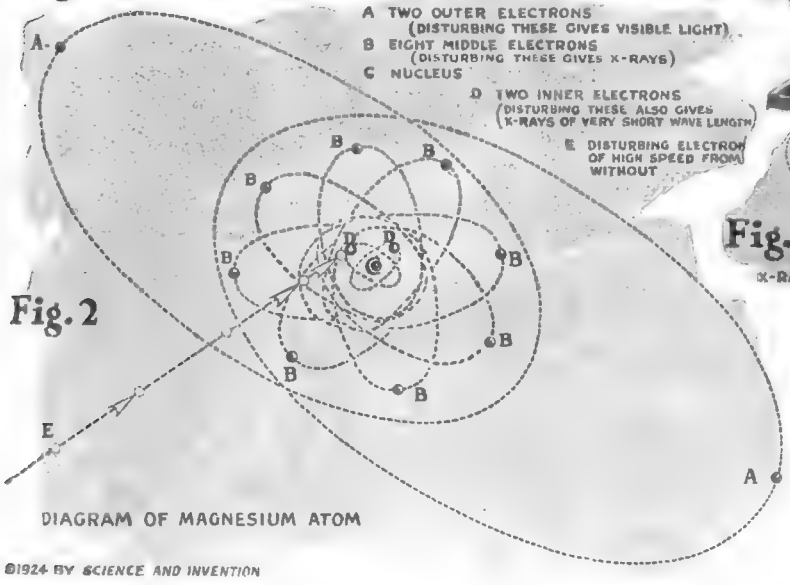

A TWO OUTER ELECTRONS (DISTURBING THESE GIVES VISIBLE LIGHT)
B EIGHT MIDDLE ELECTRONS (DISTURBING THESE GIVES X-RAYS)
C NUCLEUS
D TWO INNER ELECTRONS (DISTURBING THESE ALSO GIVES X-RAYS OF VERY SHORT WAVE LENGTH)
E DISTURBING ELECTRON OF HIGH SPEED FROM WITHOUT
A
B
C
D
E
DIAGRAM OF MAGNESIUM ATOM
©1924 BY SCIENCE AND INVENTION

Fig. 2

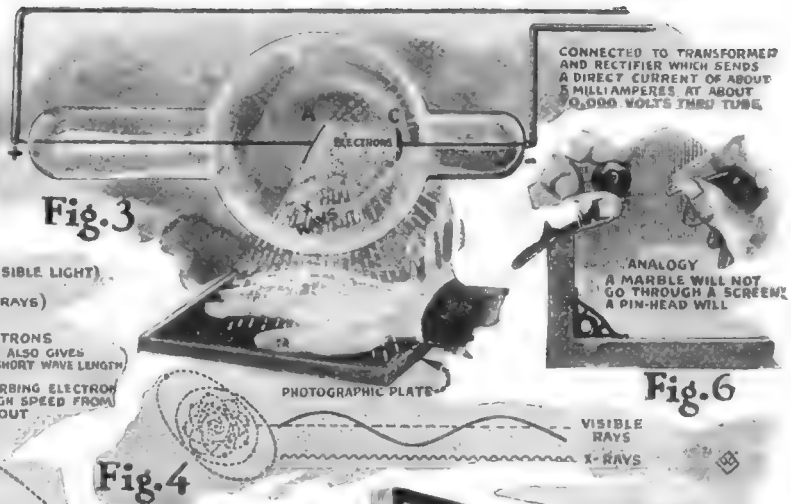

CONNECTED TO TRANSFORMER AND RECTIFIER WHICH SENDS A DIRECT CURRENT OF ABOUT 5 MILLIAMPERES AT ABOUT 70,000 VOLTS THRU TUBE
ELECTRONS
PHOTOGRAPHIC PLATE

Fig. 3

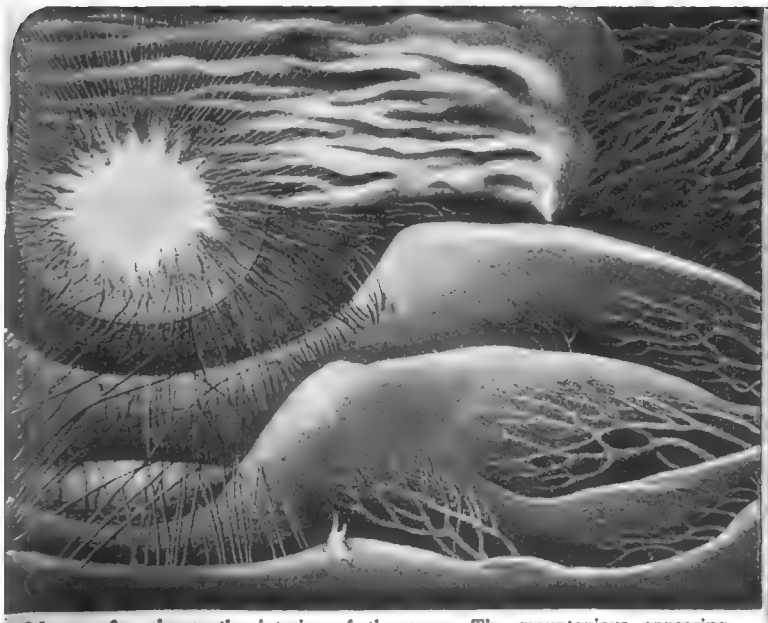
Fig. 6

Fig. 4

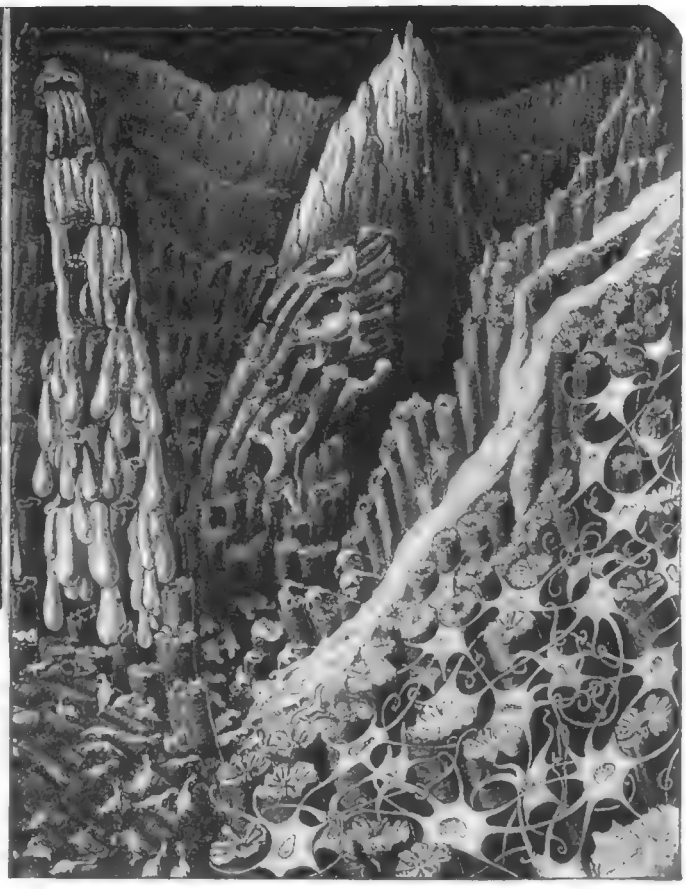
Fig. 5

An electron being forced into a magnesium atom disturbs one of the inner electrons B or D, causes them to give rise to very short vibrations, resulting in X-rays. If the two outside electrons A, are disturbed, the resultant vibrations will be light rays, (Fig. 2.) Fig. 1 shows by comparison the difference between red and blue light. Fig. 4 shows the difference between visible light and X-rays. Fig. 3 shows an ordinary X-ray tube, while Fig. 6 illustrates the penetrability of X-rays. The vibrations are so swift and small, as shown in Fig. 4, that they are enabled to pass between the atoms of ordinary substances. The analogy is that a marble will not go through a screen, while a pin goes through without difficulty.—Howard Deem.

Wonders of Our Body



Above is shown the interior of the nose. The mountainous appearing elevations are nose muscles. The interlaced veins through the agency of which the breath is heated before it is taken into the lungs, may be plainly seen at the right. The volcano-like affair is evaporating tear water. The opening of the nostril is seen at the left, as well as the heavy mat of hairs which acts as a screen to keep out the dust.—Kosmos.



At the right is shown the interior of a flesh wound. At the left are shown the drops of venal blood pouring into the wound. The flower-like affairs in the lower right corner are new cells knitting together to cover the surface, and heal the wound. Just above them is seen the flow of arterial blood into the wound, and just above the blood may be seen the broken ends of muscle fibres. The blood engages in a fight with bacteria.

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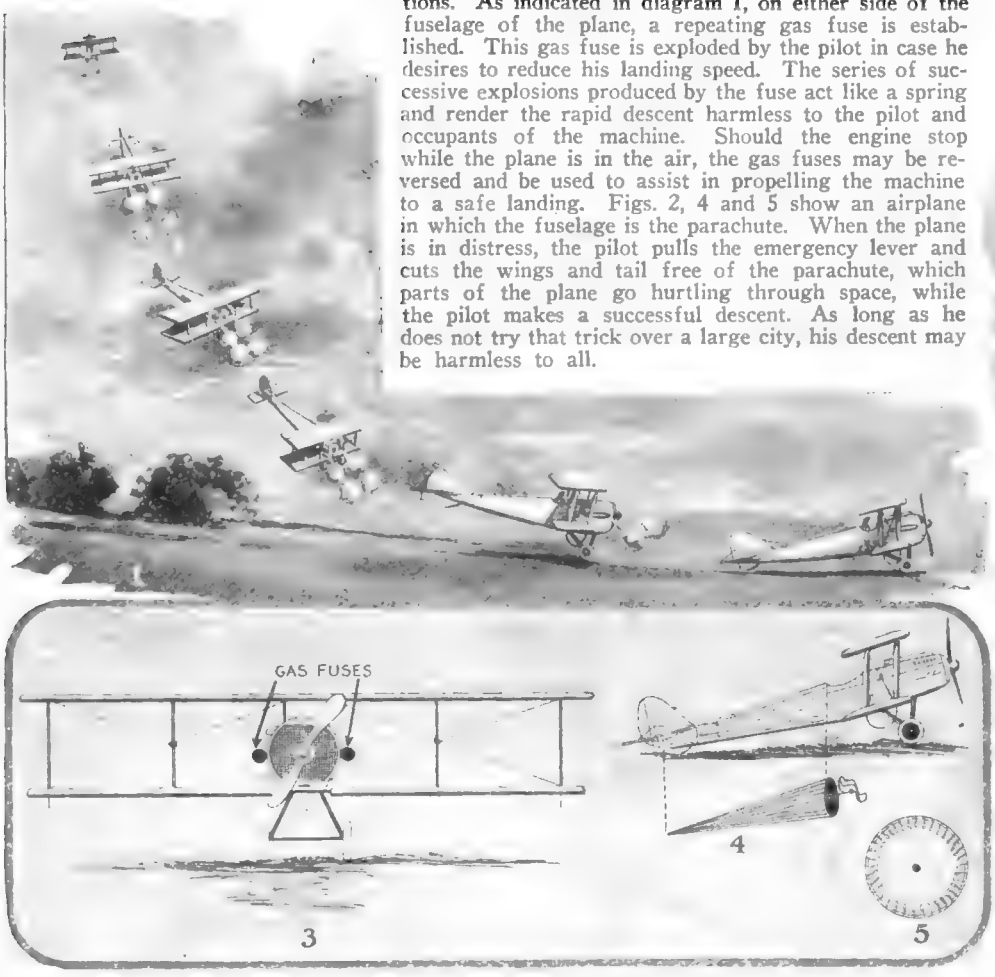
To End Air Crashes

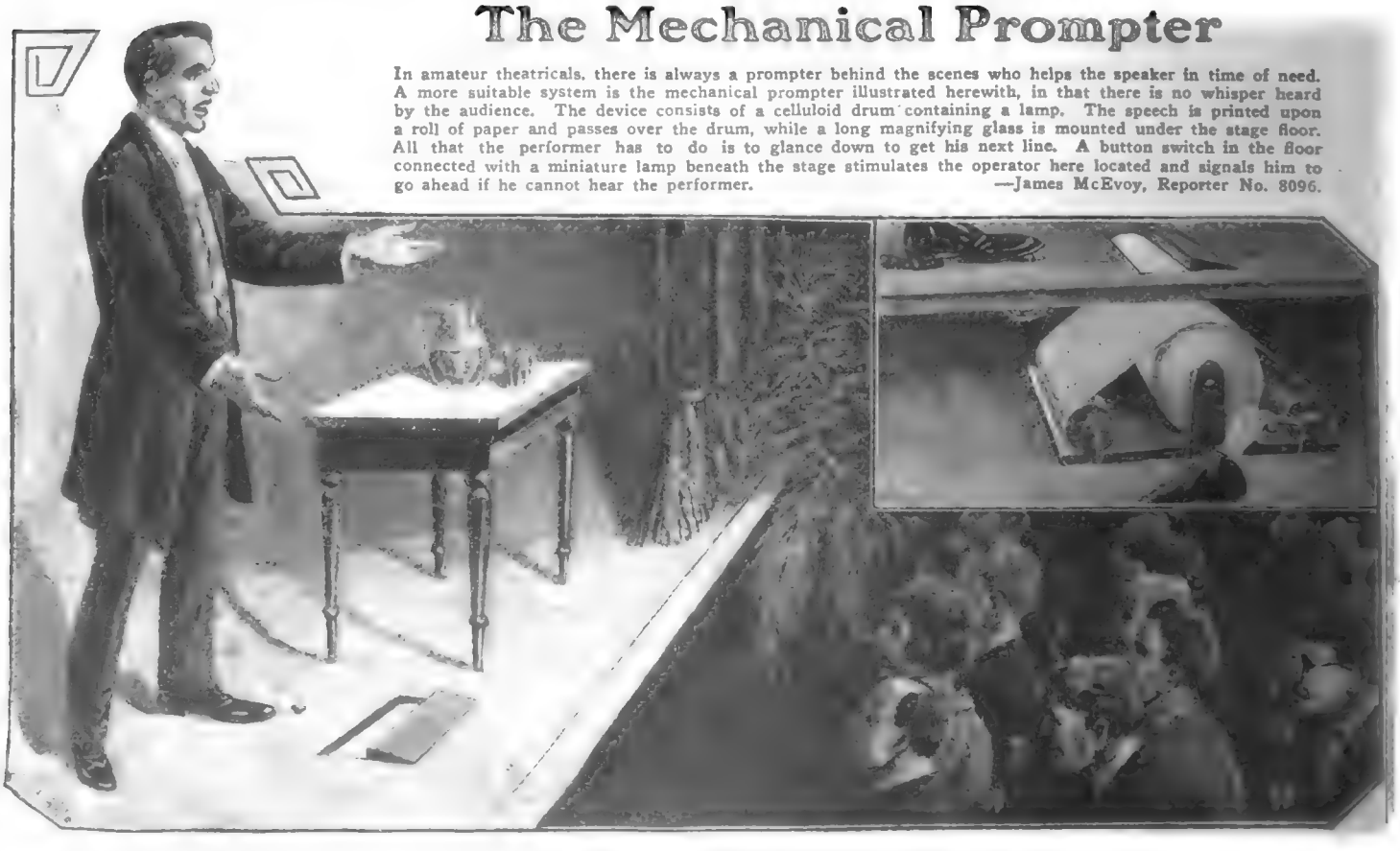
THE French military aviation service has been conducting experiments with Captain Lipente's inventions. As indicated in diagram 1, on either side of the fuselage of the plane, a repeating gas fuse is established. This gas fuse is exploded by the pilot in case he desires to reduce his landing speed. The series of successive explosions produced by the fuse act like a spring and render the rapid descent harmless to the pilot and occupants of the machine. Should the engine stop while the plane is in the air, the gas fuses may be reversed and be used to assist in propelling the machine to a safe landing. Figs. 2, 4 and 5 show an airplane in which the fuselage is the parachute. When the plane is in distress, the pilot pulls the emergency lever and cuts the wings and tail free of the parachute, which parts of the plane go hurtling through space, while the pilot makes a successful descent. As long as he does not try that trick over a large city, his descent may be harmless to all.



The Mechanical Prompter

In amateur theatricals, there is always a prompter behind the scenes who helps the speaker in time of need. A more suitable system is the mechanical prompter illustrated herewith, in that there is no whisper heard by the audience. The device consists of a celluloid drum containing a lamp. The speech is printed upon a roll of paper and passes over the drum, while a long magnifying glass is mounted under the stage floor. All that the performer has to do is to glance down to get his next line. A button switch in the floor connected with a miniature lamp beneath the stage stimulates the operator here located and signals him to go ahead if he cannot hear the performer.

—James McEvoy, Reporter No. 8096.



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Bringing Down a Zeppelin

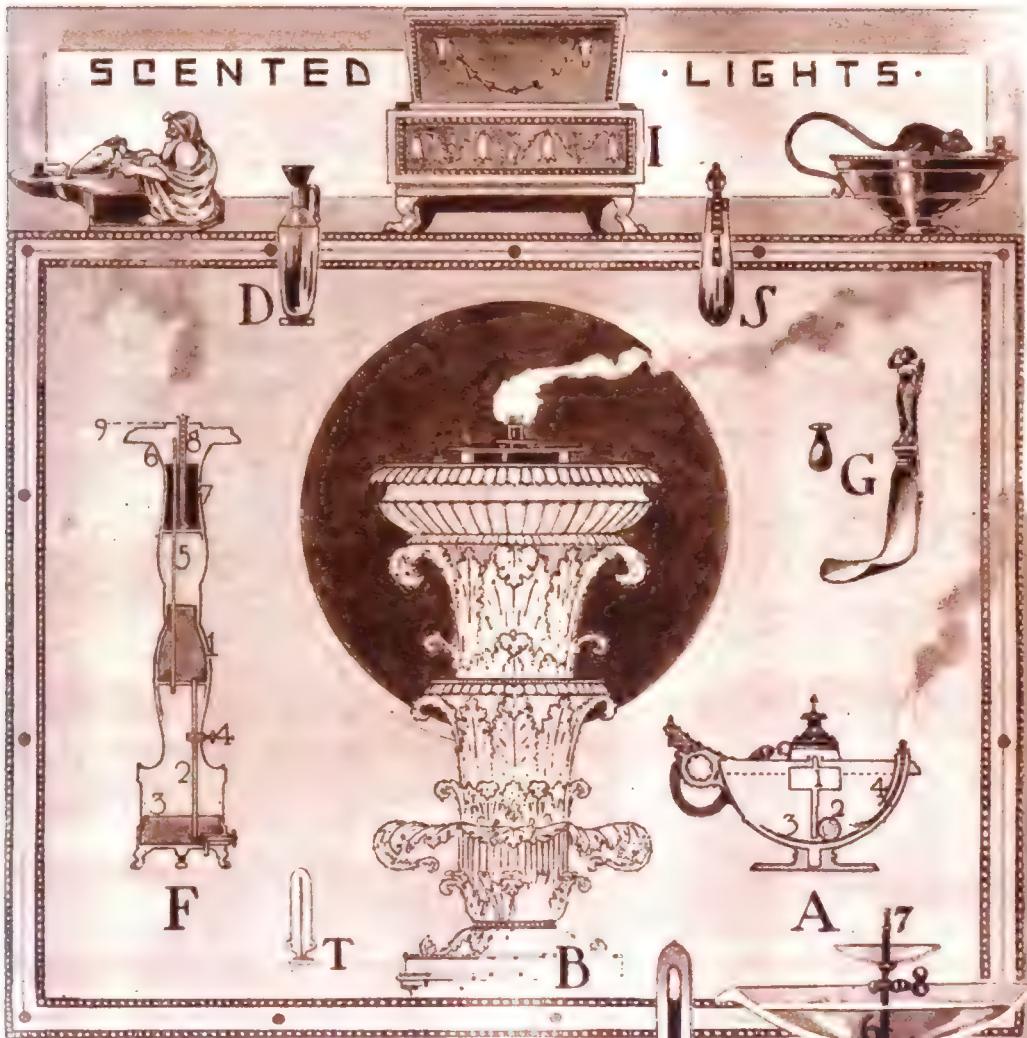
During the World War, Zeppelin raids on England were a nightly affair. The illustration above was made by an eye witness to the bringing down of a Zeppelin at Potter's Bar near London. The Zeppelin was at a great height. English pursuit planes were sent up. The ground guns opened fire and a pilot named Robertson dropped a bomb on the huge ship. With a roar, the Zeppelin burst into flames and fell. The force of the explosion turned Robertson's plane completely over but he righted it and descended in safety. The entire German crew was killed. Detail, illustrated by the author.

Google

Roman Perfume Lamps

By CHARLES BEECHER BUNNELL

Illustrations by the author.



IN the lives of the ancient Romans perfume played a large part. In fact, Nero the Tyrant used it all over his body and clothes, even including his shoes. He put perfume in his wines and had it freely distributed over carpets and furniture. The people of this time used various distributing means. Some of them are illustrated on this page. Scented lights were in general use, two of them being illustrated at the left and right of Fig. I. The latter is an official incense box. Fig. D is a "Lekuthos" or incense bottle for the dead, while S is a society perfume bottle and G a perfume oil can, also used for massaging. F is a gas producer. Water, 1, falls through 2 into 3, forms compression which is transmitted through 5 to 6 in compartment 7, forcing oil through 8 where it exudes at 9 and is vaporized by a gas flare.

THE illustration B shows a combination candelabra, stand and lamp holder. Scented candles were used in this device. A illustrates an automatic self-feeding wick in which 1 is a float which engages cog 2 which, as the oil level sinks, actuates 3 and forces wick 4 up as the oil level sinks. This was used by Nero. N is an exuder used with an "Alabastrum" T which contains the perfume. Nozzle of T rests on silk surface and will keep a room perfectly scented for months.

The other three devices are for vaporizing liquid perfume. L utilizes lung compression. In operation, valve 2 is blown into with the mouth and then closed. Opening valve 3, atomized perfume rushes out jet 1. H is a hydro-pneumatic vaporizer. Water poured in 1 flows through 4 into 3, forcing air through 5 into 2 where pressure forces perfume F through 6 out of jet 7 whenever valve 8 is opened. M is a mechanical pneumatic dispenser. 1 is half filled with perfume. Pump 2 is operated by hand, compressing air in space above perfume. This pressure forces perfume through tube 3 out of the jet in the universal joint at the top. The jet can be depressed to a 45-degree angle, allowing perfume to be thrown in all directions. Depressing jet to 90 degrees stops flow.

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IF WE HAD ANIMAL SENSES

THE triumph of the human race over nature has been so great and we have become so accustomed to our superiority over other forms of life that we are prone to believe that the human senses are paramount to the senses of all other living things. However, in his work entitled "Wireless Possibilities," Prof. A. M. Low points out many discrepancies in this idea. Our illustrations herewith depict the effect that would be created if a man were equipped with a human brain, the nose of a dog, the ears of an antelope and microscopic eyes. With these senses, life in any of the cities of today would be unbearable. Smells that would be most pleasing to the brain of a dog would nauseate a being equipped with a man's brain and a dog's nose. Our upper left-hand illustration shows the effect of such a combination. Smells that we cannot even detect with the human nose would become overpowering. Even the finest of residential sections would waft to this incongruous combination of senses odors that would be disgusting to the human being.

And then suppose that the delicate hearing senses of an antelope delivered the sounds collected by them to a human brain? Here again our cities would be unbearable. Ordinary traffic that we are so used to, would sound to us like a continuous cannonading of big guns with a few volcanic eruptions thrown in for good measure.

With these super-sensitive ears we could not even enjoy a walk through the forest. Suppose we were to seat ourselves in the shade of a tree on a grassy bank to rest. Immediately sounds of various intensities and notes would register themselves on our auditory nerves. We could hear the worms crawling around and the sounds of many different kinds of insects would be heard. Many of these sounds would resemble steam whistles of various tones.

Our microscopic eyes would lead us into further difficulty. Certain foods or liquids would present such a terrifying appearance that it would be impossible for us to eat them. Our lower left-hand illustration gives an idea of the appearance of an ordinary glass of water to a man equipped with microscopic eyes.

And so we may well believe that even though the three senses described above are inferior in man to those in animals, still we are just as well off with the eyes, ears and nose with which nature has provided us

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Accordingly, sharp at midnight, the skeleton appeared again. This time, however, it was mounted on a skeleton horse with wings.

Doctor Hackensaw's Secrets

By CLEMENT FEZANDIÉ

No. 37. The Mystery of the Walking Skeleton.

DOCTOR I. HACKENSAW was, first of all, an inventor; and an inventor is a man who, when absorbed in some great idea, is utterly oblivious to the external world. It is related that Sir Isaac Newton once started to boil an egg, but boiled his watch instead, holding the egg in his hand for a timepiece. Doctor Hackensaw, however, could have given Sir Isaac a double discount. One day that he had cooked himself an omelet in his laboratory, he was seen to throw the omelet into the stove mistaking it for a shovelful of coal. On another occasion his newspaper not having come one morning, he hastily dressed and went to the corner newsstand for a copy. He noticed that people stared at him, but it was not until he was safely home again that he discovered that he had forgotten a somewhat necessary article of his wearing apparel—namely, his trousers. As this was in New York City, the omission might have led to unpleasant consequences had a policeman chanced to see him.

Doctor Hackensaw was wealthy, for, while not a business man, he had made so many inventions of world-wide application and had increased the wealth of the country by so many billions of dollars, that a few millions couldn't help clinging to him. The consequence was that the doctor had a number of laboratories for his research work, and employed several hundred assistants.

Among these assistants was an eighteen-year-old young lady called Pepita Perkins, or more familiarly "Pep" Perkins. Doctor Hackensaw looked upon her as an adopted daughter, and she reciprocated by calling him "Pop."

It was one night when Miss Pepita Perkins was returning home at midnight from a fancy-dress ball, that she first saw *the walking skeleton.*

Now, Pep was a brave girl—on many a previous occasion she had showed that she by no means lacked courage, but the sight of a ghostly form walking the earth at midnight is enough to strike terror in the bravest heart, and Pep might well be excused for losing her head.

The trouble all began with a stalled automobile. The gentleman who was taking Pep home in his car chanced to stall when within a few rods of Doctor Hackensaw's summer cottage in New Jersey. Pep, too impatient to wait, left her escort tinkering with his machine, while she took a short cut home through the country graveyard.

Not the slightest fear did she experience, and it was without a tremor that she passed through the churchyard without even deigning to cast a look behind her. Doctor Hackensaw's grounds lay just beyond, and were surrounded by a long, high stone wall, for the worthy doctor had always many inventions in hand that he was not yet ready to make known to the general public. Bitter experience had taught him the inadvisability of taking the public into his confidence until an invention was completed and thoroughly tested.

Pep Perkins reached the massive gates that gave entrance to the grounds, was admitted by the lodge keeper, and was walking briskly toward the house when, at a sudden turn in the road, she saw it! It appeared suddenly, apparently coming out of nowhere! It appeared first as a greenish light, without any definite form, but as she gazed [illegible] startled, it slowly assumed the figure of the skeleton of a man, every bone glowing with a strange fire. Nor was the skeleton standing still—it was slowly walking directly toward her.

Pep's heart jumped into her throat, and when the skeleton opened its bony jaws, and with chattering teeth gave vent to a sepulchral laugh, and then in mournful tones droned out the words, "Hollow! Hollow! Hollow!" the poor girl almost fainted from terror.

With one wild shriek, however, she tore past the ghostly vision and rushed for the house, where with fumbling hands she had difficulty in opening the door with her latch key. To her relief the light was still burning in Doctor Hackensaw's library, showing that he had not yet gone to bed, so she rushed in, wild-eyed and breathless.

"Pop!" she cried, "do you believe in ghosts?"

Pep's heart jumped into her throat when the skeleton opened its bony jaws.

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"Scarcely, Pep," though I must humbly confess that as in all men, however much advanced, there lingers something in the back of my mind, some hereditary influence from our remote ancestors, that produces a slight nervousness occasionally in the dark, but I am always ready, and even anxious to investigate any ghostly phenomena that come to my notice."

"Then your wish is granted!" retorted Pep. "If you will go to the gate you will find a walking skeleton that chased me home because I was foolish enough to pass through the graveyard at midnight!"

Doctor Hackensaw leaned back in his chair and laughed heartily. "I'm afraid I'm the guilty one, Pep," said he, "and I must ask your pardon if I frightened you. I wasn't expecting you home so soon, as you usually don't return from a dance until the wee small hours of the morning. It was really my skeleton you saw!"

"Your skeleton?"

"Well, the words are ambiguous, I know, but you will understand the whole affair if you will listen to me.

"All right, start your explanation! As I won't get a wink of sleep to-night, I'll keep you up as long as I can talking to me and reassuring me. I was never so upset in my life! I've got the 'creeps' in the very marrow of my bones."

"To begin with," said Doctor Hackensaw, I must inform you that the existence of this walking skeleton is a profound secret. You are not to speak of it to anyone. I cannot even tell you the purpose for which it is intended, as I have promised absolute secrecy. But I will tell you all that I can. To begin with, do you know anything about radium?"

"Yes, I know that a pinch of it costs a fortune and that it is continually shooting off particles and changing into lead."

"Precisely. The half period of radium, that is to say, the time required for half a given weight of radium to disintegrate, has been calculated as about 1690 years. In other words, unless new radium is forming, there must have been twice as much radium on earth 1690 years ago as there is at present, four times as much 3380 years ago and so on. By making the calculation we find that one hundred thousand years ago or less the whole earth must have been one solid mass of radium! This, of course, is an impossibility for our geologists have proved that one hundred thousand years ago the earth was pretty much as it is now. Consequently, the inference is that new radium must be produced continually to replace the old one that is used up. Scientists argued that if radium was being produced at present, the substance from which it was produced must be found close to the radium in every locality where radium was found, and always in the same proportion. Such a substance is Uranium. Uranium is much more common than radium and always exists with it, and the proportion present is constant. In all radium ores there is about three million times as much Uranium as radium. Hence, it is evident that Uranium is disintegrating into lead, though no direct proof of the fact has yet been had. The fact is that the half period of Uranium is five billion years and consequently many years must elapse before a perceptible amount of product can be obtained. Professor Soddy tried the experiment some years ago. The Uranium itself is soon decomposed. It throws off helium gas—one atom of helium being given off by each atom of Uranium. The product is called Uranium X, and although Doctor Soddy started the experiment in 1912, seven years later in 1919 he was unable to detect the formation of any radium. Just think of it! Seven years of experimenting! Yet the experiment continues and the triumph of science will be great on the day that the presence of radium in his tube shows that the actual transformation of Uranium into radium shall be made manifest. Doctor Soddy calculated that if he continues the experiment sixty thousand years he will produce about one cent's worth of radium—not a very satisfactory financial result, but scientists are seldom good financiers!"

Pep Perkins yawned and wished that she had remained at the ball. This lecture on radium was as bad in its way as the sight of the phosphorescent walking skeleton, and she determined to make a diversion.

"Pop," said she, "it's too late to-night for all that josh about radium. All I want to know is what that skeleton was that I saw near the park gate."

"Well, that was just what I was explaining to you," returned Doctor Hackensaw patiently. Uranium is the heaviest metal known, having an atomic weight of 238. It is continually disintegrating very slowly into other substances, finally producing Uranium X_2 with an atomic weight of 234. This is really Uranium with a helium atom (atomic weight 4) thrown off. This Uranium X_2 doesn't live two minutes, but also disintegrates, finally producing ionium, and this in turn produces radium whose atomic weight is 226, thus showing that radium is nothing but Uranium with three atoms of helium expelled from each atom of radium. Now the radium itself disintegrates. It begins by . . ."

"Good night!" cried Pep, stamping her foot impatiently. "Do you think I'm going to stand here at one o'clock in the morning listening to a lecture. I'm going to bed!"

"All right, Pep," assented the doctor, mildly. "And by the bye, if you want more particulars about the walking skeleton, you can get them if you come with me to-morrow. I am starting to-morrow for a month's trip to Africa, and Sam, which is the name I have given the skeleton, comes along with me.

CHAPTER II

"Isn't this glorious!" cried Doctor Hackensaw, as his express airplane, *The Arrow*, skimmed gracefully through the azure sky while the deeper blue billowing waves of the Atlantic played below them.

"Yes, it's dandy!" echoed Pep, "and now that we're on our way perhaps you will condescend to give me some explanation as to where we are going and what we are going to do, and what "Skeleton Sam," as you call him, has to do in the matter."

"All right, Pep; there is no reason why I should keep the matter secret any longer. Did you ever hear of Robert Houdin?"

"Yes. He was a famous conjurer, wasn't he?"

"Precisely. Well, though he has been dead many years, he is responsible for the

(*Continued on page* 1140)

The sentinels suddenly saw appear before them a giant skeleton with luminous bones shining with a baleful greenish fire!

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Jelly Fish Destroy Fish

Jellyfish, those useless, flabby denizens of the sea, have developed an appetite for herring and haddock and threaten to soon banish these fish from the North Sea where the jellyfish have appeared in large numbers.

Jellyfish one to six feet in size are now common in the waters of the North Sea. Swimmers stung by them have been known to go temporarily insane. Illustrations above show jellyfish in action.

Above: A type of jellyfish found in the waters about Jamaica Bay, L. I. This type of jellyfish has not as yet seriously interfered with the supply of food fish for which the shallow waters of this bay have been celebrated—H. J. Shannon.

Flying Boat

THE very latest development in the line of vehicles for water travel is the newly completed Rohrbach flying boat illustrated directly below. The device resembles a cross between a common sail boat and an airplane. The hull is built along lines similar to the fuselage of an aerial hydroplane, which gives the boat a very small draft and reduces its resistance to the water. To further aid in cutting down this hindrance to speed, airplane wings are mounted on the sides and the tail is equipped with a horizontal rudder. The vertical rudder is for steering. The boat obtains its motive power from a pair of sails and two airplane engines equipped with air screws. This vehicle is reported to have broken many speed records.

Sinking Movie Ship

AMONG the many tricks used in motion picture photography today, those employing miniature scenes are probably the most effective. The illustration directly above shows operators in the act of photographing a sinking ship scene. When the finished film is thrown on the screen, the effect is one of a storm at sea wherein the ship, apparently full size, is damaged and sinks. The entire illusion is accomplished with miniature scenery.

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More Gambler's Tricks Exposed

By MARK MELLEN

The Man Who Fooled P. T. Barnum

THERE is probably more gambling being done with dice in this country than with cards or any other equipment. Craps is the favorite game of the colored population, as well as with many of the youngsters of white blood. In all gambling houses the bones are rolled for high stakes. One reason for the popularity of the game is its simplicity. Anyone can learn it by watching the game for five minutes. Another reason is that it requires no table or other equipment, and in this respect differs from poker, roulette, faro and other games of so-called chance. Anyone can carry a pair of dice in his pocket without attracting attention, and the game can be started on the floor of the stable or garage, on the counter of the cigar store, saloon or barber shop, or even right out on the sidewalk. Two dice, two people and two cents are all that are needed to start a game. My experience has shown me that most persons who play the game try to cheat at it. The manufacturers of dice recognize this fact and manufacture loaded (unfair) dice and also offer for sale the materials which will enable an energetic crap shooter to "roll his own."

Note this advertisement of a house specializing in dice. It is interesting to read and should convince you that it is folly indeed to play a game in which the chance of fair play is so small.

Even if you are able to satisfy yourself that the dice are not loaded, you are not safe. Super liquid applied to the dice softens one of their surfaces, and makes them roll so as to insure financial disaster to the uninitiated.

SUPER-LIQUID

Our Super Liquid is so called because of its super qualities. It is so superior to the ordinary liquids sold by other firms that there is no comparison. When this liquid is applied to the dice, it apparently soaks in and softens the chipped dice. It does quickly, takes a high and lasting dice. It does quickly, takes a high and lasting [illegible] makes the best imitation chipped dice ever produced. The result is practically undetectable and smooth surface. It will not become gummy and pick up dirt. We are the only firm producing this wonderful liquid at the present time, and you should get it before it becomes too well known. It is guaranteed to do as we say and to bound to please.

Super Liquid with instructions. Large bottle $1.00
Special Brush. Each .25
Liquid Treated Dice. Pasaro or Misners. Per set 3.00

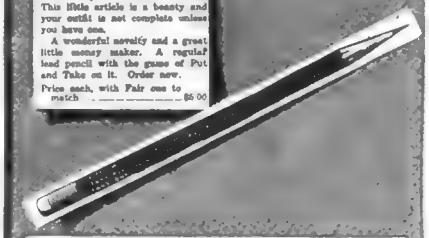
Modern gambling devices are almost invariably crooked. Dice like the dog in the phonograph "ad" knows "its master's voice" and responds. Even the innocent looking put and take pencil as illustrated below is crooked. When rolled in one direction it turns to "take," and if reversed end for end and rolled again, it will read "put."

PUT AND TAKE PENCIL

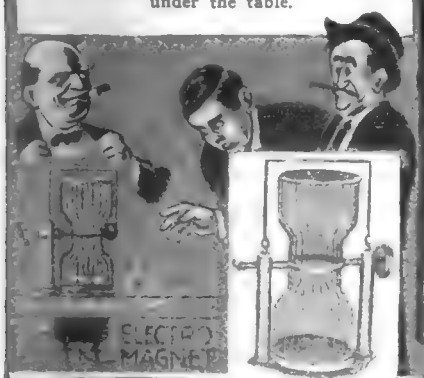
This lead pencil has the regular game of Put and Take on it and it is a great pocket novelty. Can be controlled so that you can make it come up Put or Take at will. This little article is a beauty and your outfit is not complete unless you have one.

A wonderful novelty and a great little money maker. A regular lead pencil with the game of Put and Take on it. Order now.

Price each, with Pair one to match $5.00



Dice are loaded to make them work to advantage of the one who knows how to manipulate them. One pair is quoted at $18.00, a seemingly ridiculously high price for a pair of dice, but they sell, and the buyer profits at the expense of the uninitiated. Below we see the regulation chuck luck cages. The dice in the cage are often magnetically controlled, the electro-magnet being placed under the table.



REGULATION CHUCK LUCK CAGE

The regulation Chuck Luck Cage shown herewith is the most durable and practical cage on the market. The cage is handsomely nickel-plated throughout, fitted with our special invisible stop, also multiple gear bell.

This cage stands 18½ inches high, weighs 18 pounds and is 9½ inches in diameter. The cylinder is crossed by four strands of heavy catgut which break the fall of the dice and the ends are made of the best grade of sheep skin.

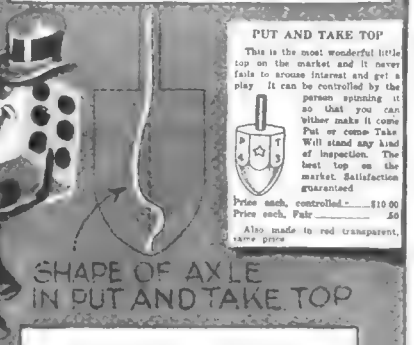
The put and take top illustrated below is also not on the level. Nearly everyone spins a top of this nature to the right and when he does so he loses more often than wins. The one in the "know" will spin the top to the left and win more often than lose. The top is loaded against the player.

PUT AND TAKE TOP

This is the most wonderful little top on the market and it never fails to arouse interest and get a play. It can be controlled by the person spinning it so that you can either make it come Put or come Take. Will stand any kind of inspection. The best top on the market. Satisfaction guaranteed.

Price each, controlled $10.00
Price each, Pair ..... .50

Also made in red transparent, same price.



Below we see a clipping of dice makers' supplies. It will be noted that various materials are used, although platinum and gold are used in the $18.00 pairs of dice. Liquid celluloid cement is used to make the celluloid rope stick fast in the hole which has been bored in the dice and filled with amalgam to make one side heavier than the other.

DICE MAKERS' SUPPLIES

Liquid celluloid, cement per bottle $0.50
Canvas spotting paint any color, per bottle ..... .50
Bone dice drills, each ..... .50
Steel dice for trimming out, each ..... .75
Aluminum for trueing dice mats, per ounce ..... .75
Polishing cloth to restore finish, per cake ..... .25
Cork for mounting dice, any size, per lb. 1.50
Paper for gauging dice, three feet 1.00

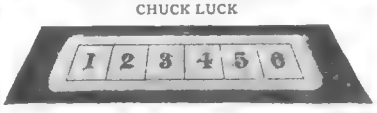
DICE MAKERS' OUTFIT

Below is the Chuck Luck layout. The player places a bet on any one of the numbers. Three dice are then rolled. If his number shows upon one of the three dice, the player doubles his money. The dice being rolled by hand the operator often manipulates one of them by holding it in the crook of his little finger, sliding it instead of rolling it—an advantage of 33 1-3 per cent.

The rolling log illustrated below is much like the put and take pencil. If rolled naturally a low number will show. If the ends are reversed, 5, 6, 7 or 8 will appear. The shape of the ridges dividing the eight sides determine the fall.

DICE GAME SUPPLIES

CHUCK LUCK



Size 18x48, hand painted in colors on enamel cloth ..... Each 8.00
Size 18x48, hand painted in colors and gold on broadcloth ..... Each 60.00
Size 36x60, hand painted in colors on enamel cloth ..... Each 7.50

Missouri Set No. 211

For Banking or Fading

This set commonly known as missouris consists of four dice two special dice with a number of spots on each side and two regular dice as to the regular number of spots on each side and two regular dice as to the regular number of spots on each side and two regular dice as to the regular

Handkerchief Tricks

By WALTER B. GIBSON

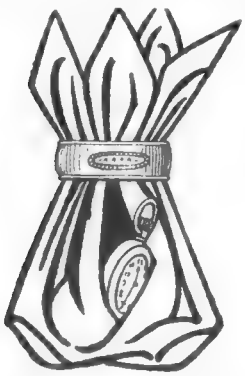
Can you make a handkerchief stretch? Can you tie a knot in a handkerchief without letting go of the ends? Can you demonstrate that a handkerchief is fireproof, and can you prove that one from four equals five? All of these effects may be produced by duplicating the systems illustrated on this page.

Fold the arms as indicated above, grasp the ends of a handkerchief and unfold the arms without letting go of the ends. A knot will form in the handkerchief.

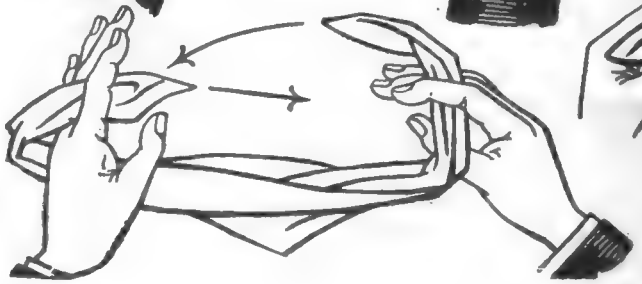
A handkerchief first folded in the hand can be made to stretch as indicated below.

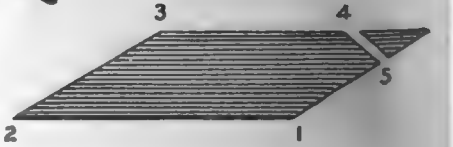
A knot can be tied in a handkerchief with one hand as shown below. Shake the hand so that the loop slides off the fingers. One from four equals five, cut one corner from a handkerchief. It now has five corners.

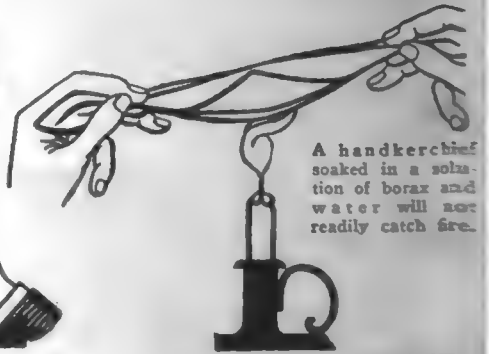
The four corners of a cloth containing a watch are pushed through a napkin ring, and the watch removed, as shown.



One quick movement made as illustrated, and a knot is tied in the handkerchief.







A handkerchief soaked in a solution of borax and water will not readily catch fire.

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Magic for Everybody

By PROF. JOSEPH DUNNINGER

NO. 24 OF A SERIES

A very good method of loading materials into a hat is illustrated in Fig. 1. The performer borrows a hat, drops it; he brushes it off with the mechanical brush illustrated, and drops the load into the hat.

Fig. 2 illustrates the paddle selector. The performer forces a card upon one of the audience, then tosses a duplicate deck into the air. His assistant swats at the deck and the selected card appears upon the paddle. The paddle is covered with velvet and has a secret pocket holding a duplicate of the forced card.

A low stand as in Fig. 3 is placed in the center of the stage which the magician covers with a cloth. On drawing the cloth away an immense flower pot full of flowers is visible. The flowers are concealed in the legs and pass down beneath the stage.

The string of the pull illustrated in Fig. 4 passes through the vest pocket and down the trouser leg. With its aid a coin may easily vanish from a handkerchief.

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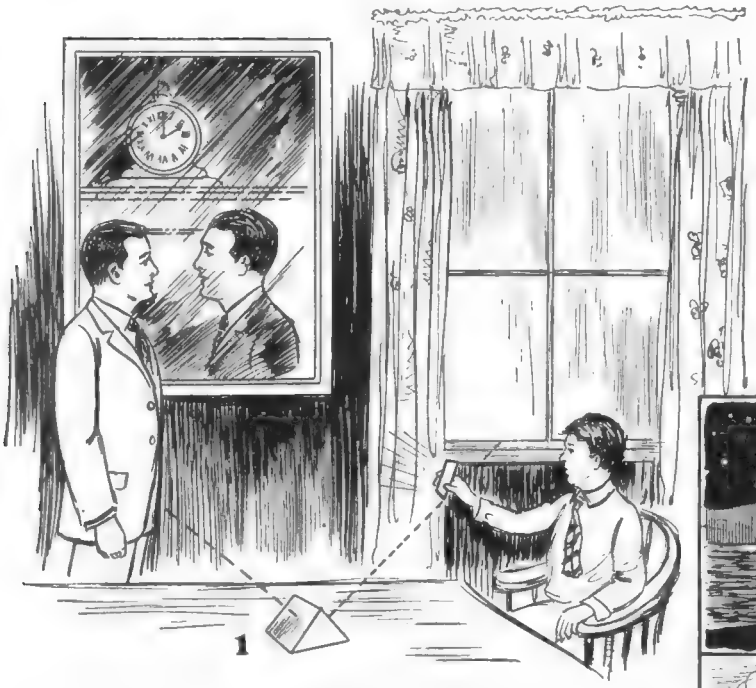
Scientific Problems

By ERNEST K. CHAPIN



1

Directly above we show an illustration in which there are scientific discrepancies. Note the position of the man in reference to the mirror, the position of the reflection, the refraction through the prism, and the position of the mirror in the boy's hand. What is wrong?

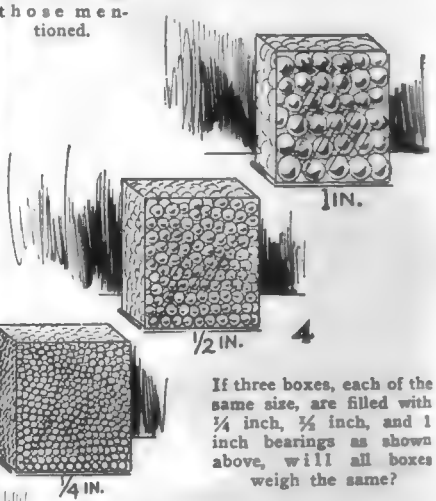
It is very difficult and often impossible to swat a bumble bee with an unperforated paddle, while it is relatively easy to hit one with a paddle through which a number of holes have been drilled. Why is this true?

2

In the case with the man with the paddle illustrated above and to the right, a paddle of thin metal and one of wire mesh might be substituted for those mentioned.

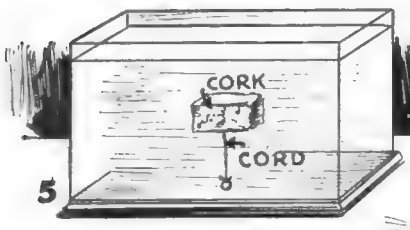
3

Which, in the course of a year, averages longer, day or night?



4

If three boxes, each of the same size, are filled with ¼ inch, ½ inch, and 1 inch bearings as shown above, will all boxes weigh the same?

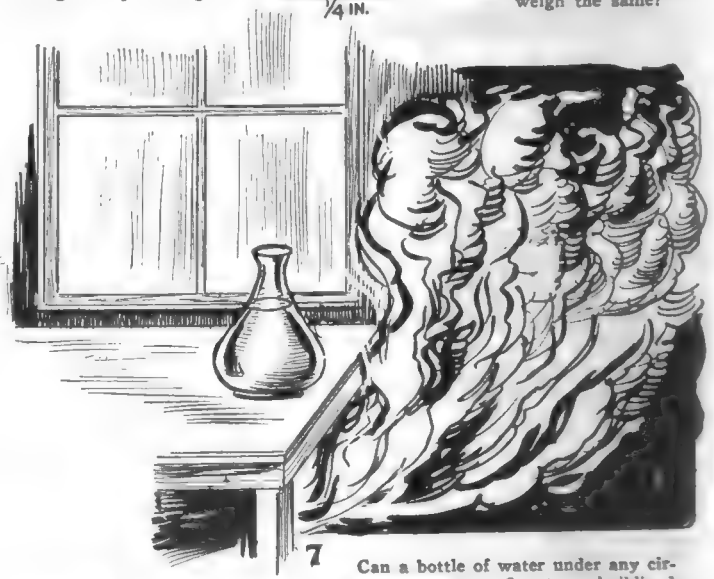


5

If the tank shown above were falling freely and the string were cut, what would happen to the cork?

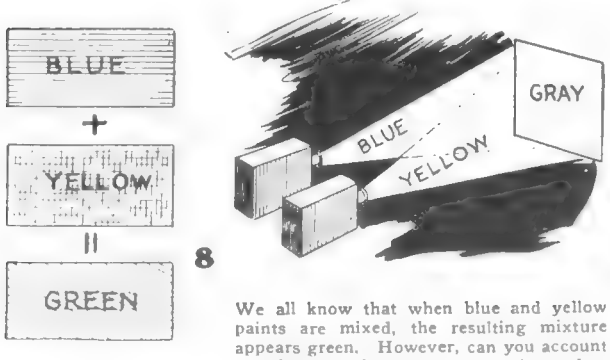
6

The illustration directly above shows a well-known type of storm that is often illustrated and called a cyclone. Is this the name of this type of storm?



7

Can a bottle of water under any circumstances set fire to a building?



8

We all know that when blue and yellow paints are mixed, the resulting mixture appears green. However, can you account for the fact that these two colors when projected on a white screen produce a grayish tint?

9

Would a two pound stone moving thirty feet per second, or a three pound one moving twenty feet per second, hurt most?

(Answers given on page 1155)

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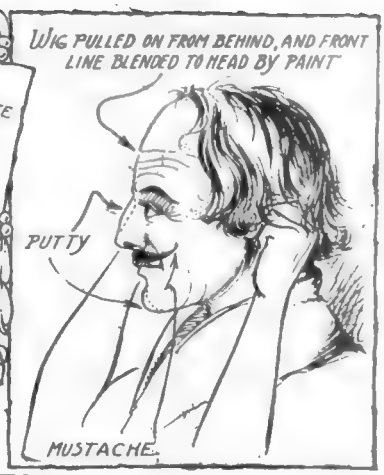
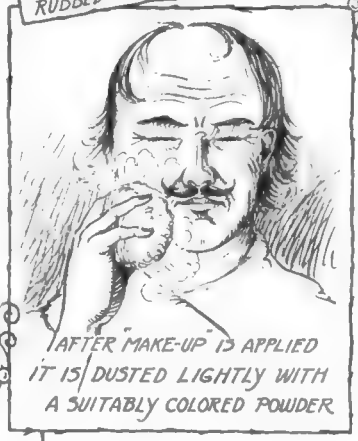
How Amateur Actors Make-Up

By L. B. ROBBINS

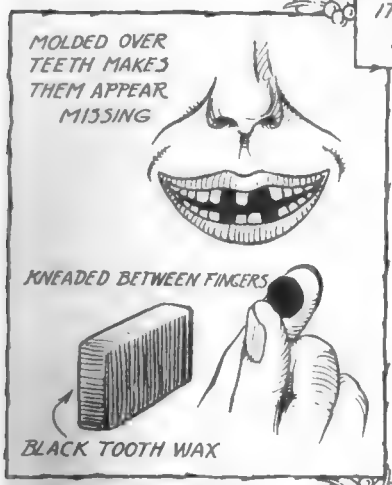
WRINKLES
COLOR TO ACCENTUATE EYES
COLOR ON CHEEK
NEXT-THE DISTINGUISHING FEATURES ARE DRAWN IN SIMILAR TO DRAWING A PORTRAIT



In the figure above the actor is ready to put on his make-up. To the right he is seen with the daubs of ground color spread out over his face. The next figure to the right illustrates how the distinguished facial expressions are applied. The wig is then pulled down over the head after the nose has been built up with putty, and the mustache app'ied. As illustrated below, the semblance of missing teeth can be produced by using black wax which is molded over the teeth.

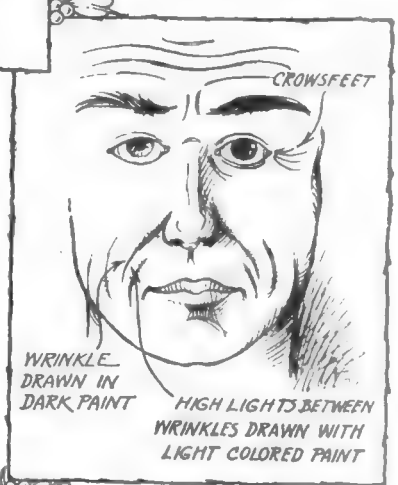


The two illustrations to the left indicate the final touches in the amateur make-up. To heighten the eyes and enlarge them, the eyebrows are darkened with paint and the lashes touched up. Then a dark line is drawn above and below the edges of the lids to meet at the outer corner of the eye. Features may be altered with nose putty as illustrated on this page, and a plump hand is made to appear aged and scrawny, by giving them a neutral shade and then coloring as illustrated below left.



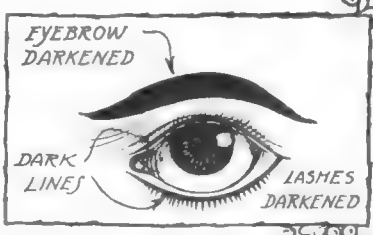
The use of tooth wax is shown above.

MANY amateur theatricals fall flat in one essential, namely that of stage make-up. When one considers the art as a whole, he will find that making up for the play is very simple. In order to simplify the process still more, the illustrations on this page are made in such a way that each process is clearly brought forth. The colors and paints are scientifically prepared and are available in handy containers ready for instant use. All that the actor really has to do is to visualize the character in his mind and then prepare his own features with color and line to form that character. The process in general is as follows: The actor seats himself before a well lighted mirror with the powders and grease paints spread out in front of him on the table. A towel or cloth is wrapped around the neck for protection, and then cocoa butter or cold cream is rubbed thinly into the skin to fill the pores and prepare a suitable surface to work on. Making wrinkles successfully is an art in itself. They are first drawn in the required place with a sharp lining stick, then just above each line or between two adjacent ones, a line of lighter color than the flesh is filled in. This is the high light; the dark line is shadow. These two lines are then softly blended with the finger to tone them down. The other features of the make-up are shown on this page.



Above one sees the method of producing wrinkles.

How a plump hand looks when aged.



The natural eye and the effect upon it when properly made up, is here illustrated.

How nose putty can alter the features.

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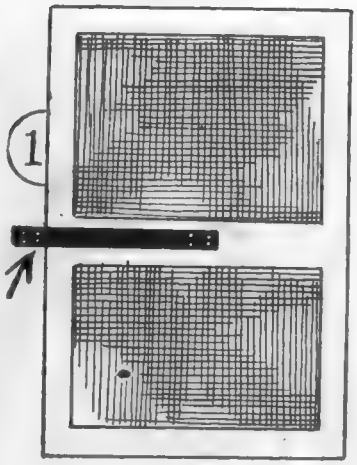
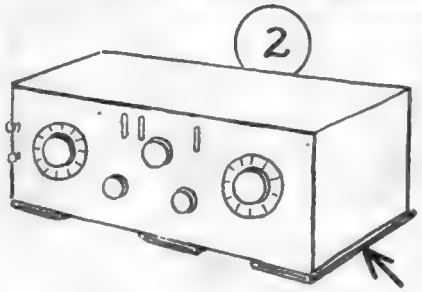
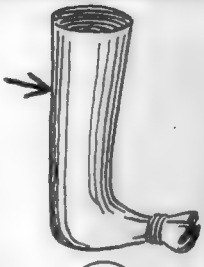
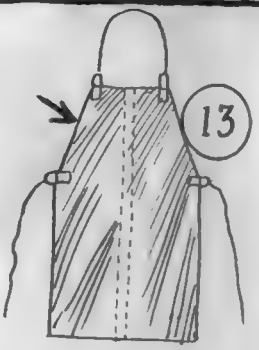
Inner Tube Contest

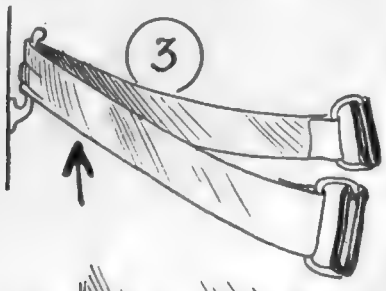
Thirty-five Combination



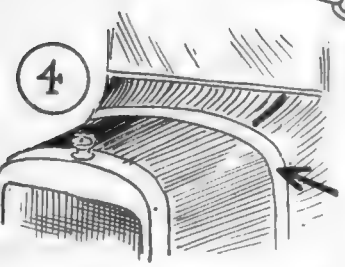


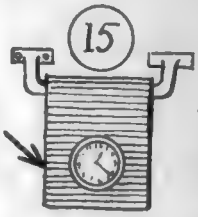


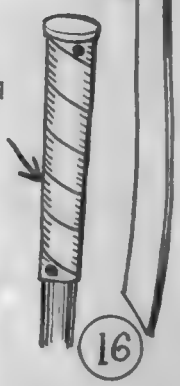


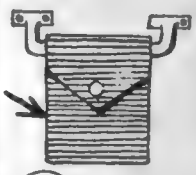


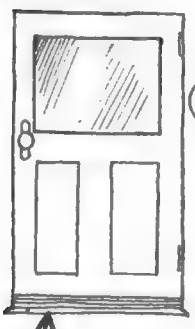
THIS beautiful combination of pen and pencil in one unit will be given away to those submitting the best suggestions or uses of inner tubes in this contest. The point is solid fourteen karat gold. The pen is of the self-filling type and the pencil at the opposite end propels, repels and expels the lead. The pen is engraved withthe words, "Awarded by Science & Invention Magazine". The thirty-five suggestions thought best in the opinion of the judges will receive the awards. In event of ties for any of the awards, contestants so tying will also receive the combination pen-pencils. Contest closes in New York City, Friday, May 1st, 1925, at 12 noon. All entries must be in our hands at that time.

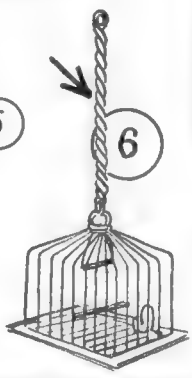


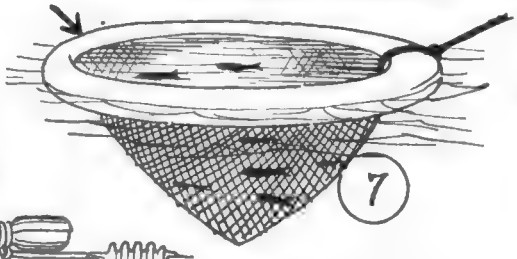


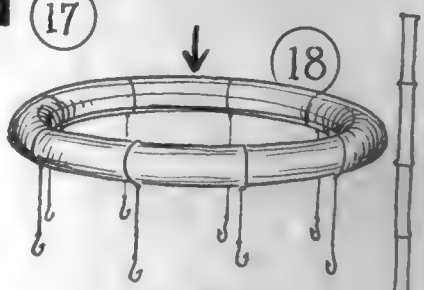


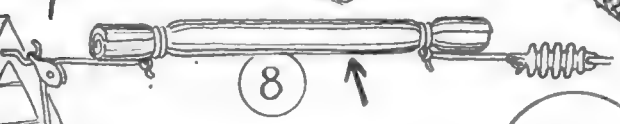


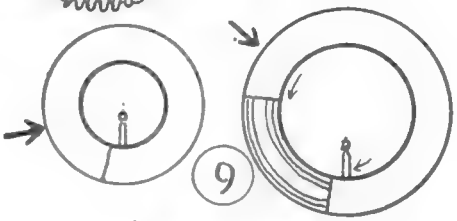


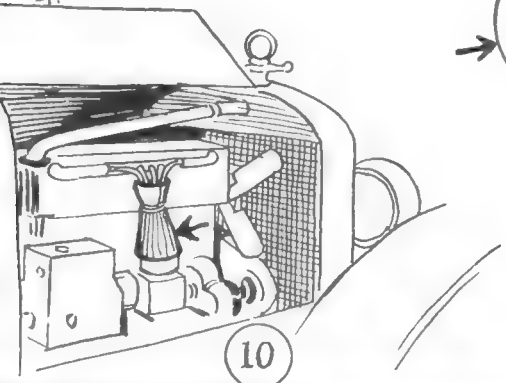


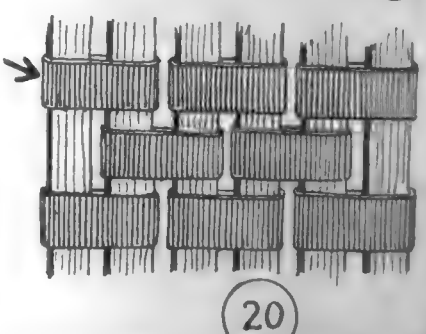












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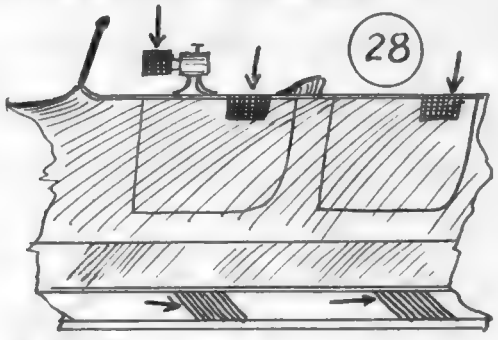
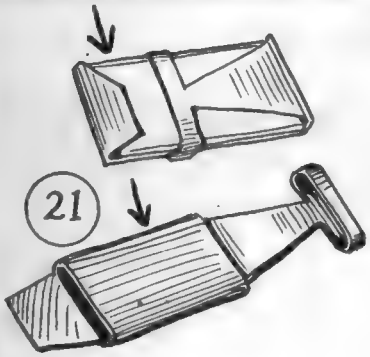
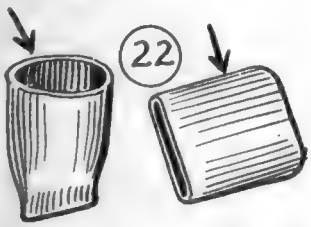
---Special Prizes

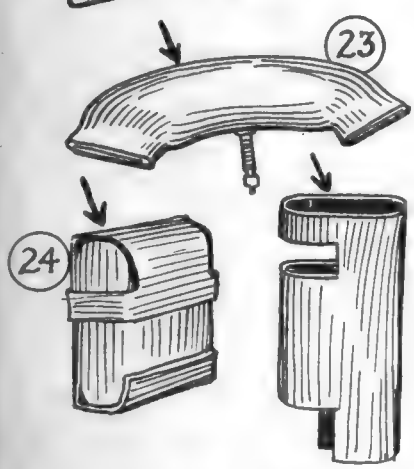
Pen-Pencils to Be Given

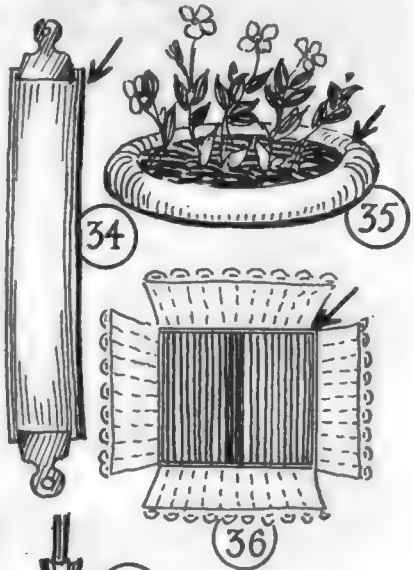


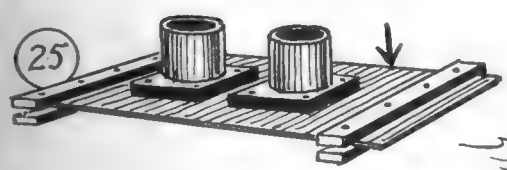


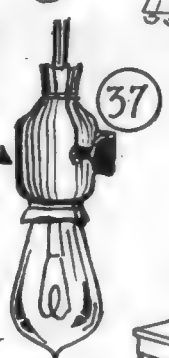


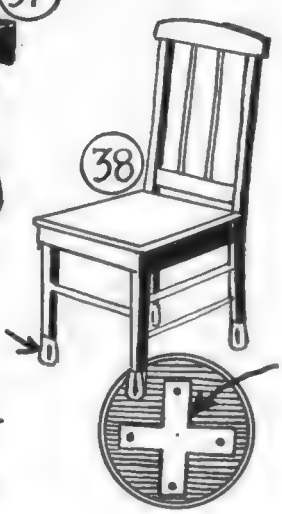
IN this contest any kind of inner tube or tubes may be used, and the tubes may be riveted together, sewed or cemented, to make articles of various types similar to the suggestions found on this page. No suggestion on this page will be awarded a prize. Briefly, the items described are as follows: 1—Screen door spring. 2—Shock absorber for radio set. 3—Exerciser. 4—Anti-rattler for cars. 5—Weather strip. 6—Bird cage spring. 7—Minnow net. 8—Strain insulator. 9—Pneumatic seat. 10—Distributor shield. 11—Camp chair. 12—Boot. 13—Apron. 14—Change tray. 15—Watch holder for cars. 16—Handle for clubs. 17—Car change purse. 18—Multiple float and gaff for fishing. 19—Replacing shoe soles. 20—Lath and rubber mat. 21—Document envelope. 22—Drinking cup. 23—Hot water bottle. 24—Tool holder. 25—Socket mounting. 26—Rubber bands. 27—Mat of woven strips. 28—Running board mat, door protector and horn protector. 29—Life preserver. 30—Suspenders. 31—Life preserver. 32—Fly swatter. 33—Bathing bag. 34—Film developing tank. 35—Flower pot. 36—Porch pillow. 37—Socket protection. 38—Chair skids. 39—Phone cushions. Address manuscripts or models to Editor. Inner Tube Contest, c/o Science and Invention Magazine, 53 Park Place, New York City.

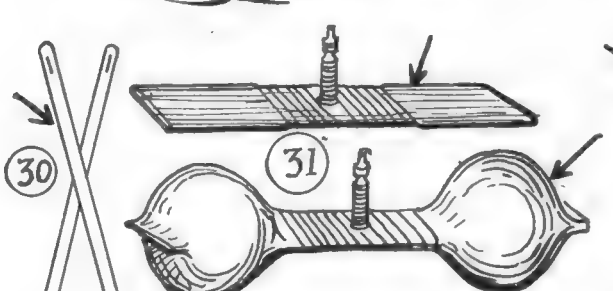


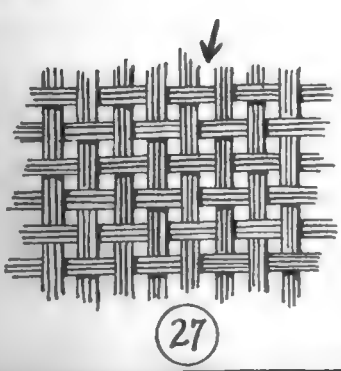


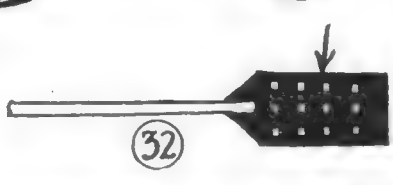


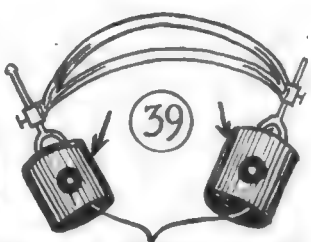












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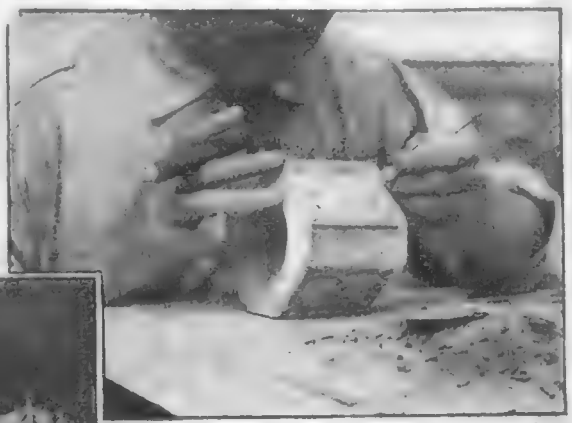
THE CONSTRUCTOR

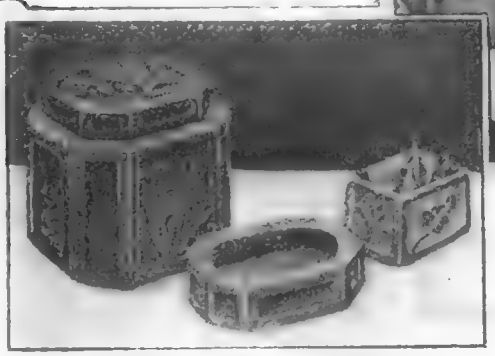
Making Your Own Antiques

ALTHOUGH clay is most frequently used for molding, still it can be carved if care is used and decorative articles of an antique appearance made from it. Select clay that is as soft as talcum and feels oily or soapy to the touch. Be sure it contains no grit or sand. This may be had in many colors and often two or three colors may be used in one article effectively. Mix the clay to the consistency of thick dough and mold roughly to the desired shape. Always make the rough mold slightly larger than the finished object is to be, in order to provide sufficient material for carving. Be sure no air pockets are present.

Above: When a cavity is to be in the finished object, it is formed in the still plastic clay with a round tin can.

The roughly molded block is shaved to shape with a thin, but not necessarily sharp, knife.





Above: Some of the decorative objects made by the process described herewith.

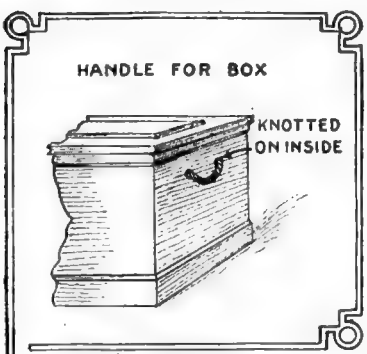
Above: Accomplishing the carving with a small pen knife. The design may be lightly traced on the clay and the surrounding parts cut out so that the design stands in relief. This work is done after the inside cavity has been smoothed. The walls should be ¾" to 1" thick, although for smaller objects ½" will be sufficient. To preserve these objects, two or more coats of hard drying varnish should be applied. Collodion may also be used.—Dr. Ernest Bade.

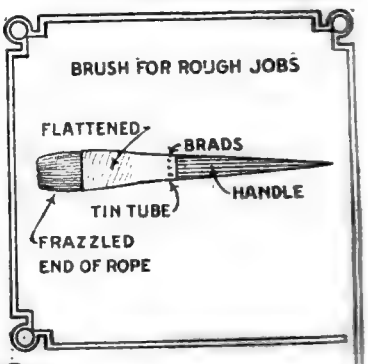
Above: A smoker's set of unique design made of clay.

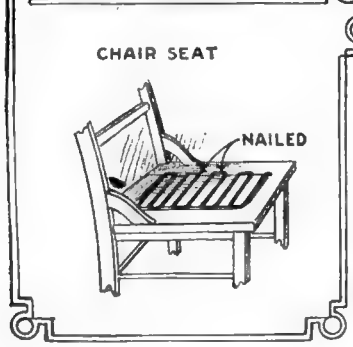
Odd Uses for Rope

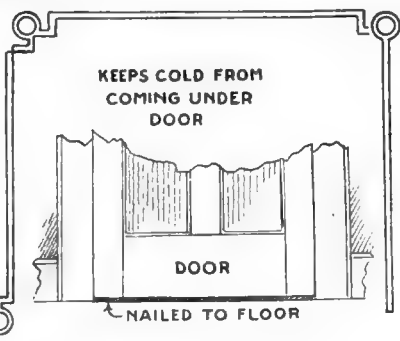
Short ends of rope that are no longer useful for their original purpose may be put to other uses as illustrated herewith. Left: Handles for boxes made by passing the rope through two holes in the side of the box and knotting inside. Lower left: A chair seat made by running several strands of rope across the chair and nailing in position. Below, left center: Nailing ropes in place provides a good weather strip. Below, right center: A short stub of rope makes a temporary cork. Lower right: A rope mat made by sewing the rope together in the form shown. Right: A rough brush may be made by fraying the ends of a piece of rope, clamping in a tin tube as shown and fastening a handle in place. The end of the brush is trimmed off square.

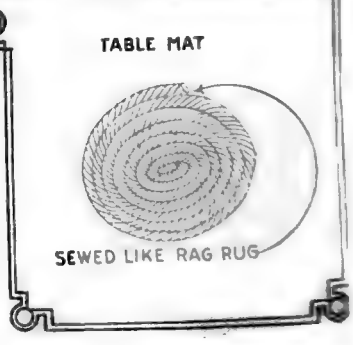
—Arthur Flinner.











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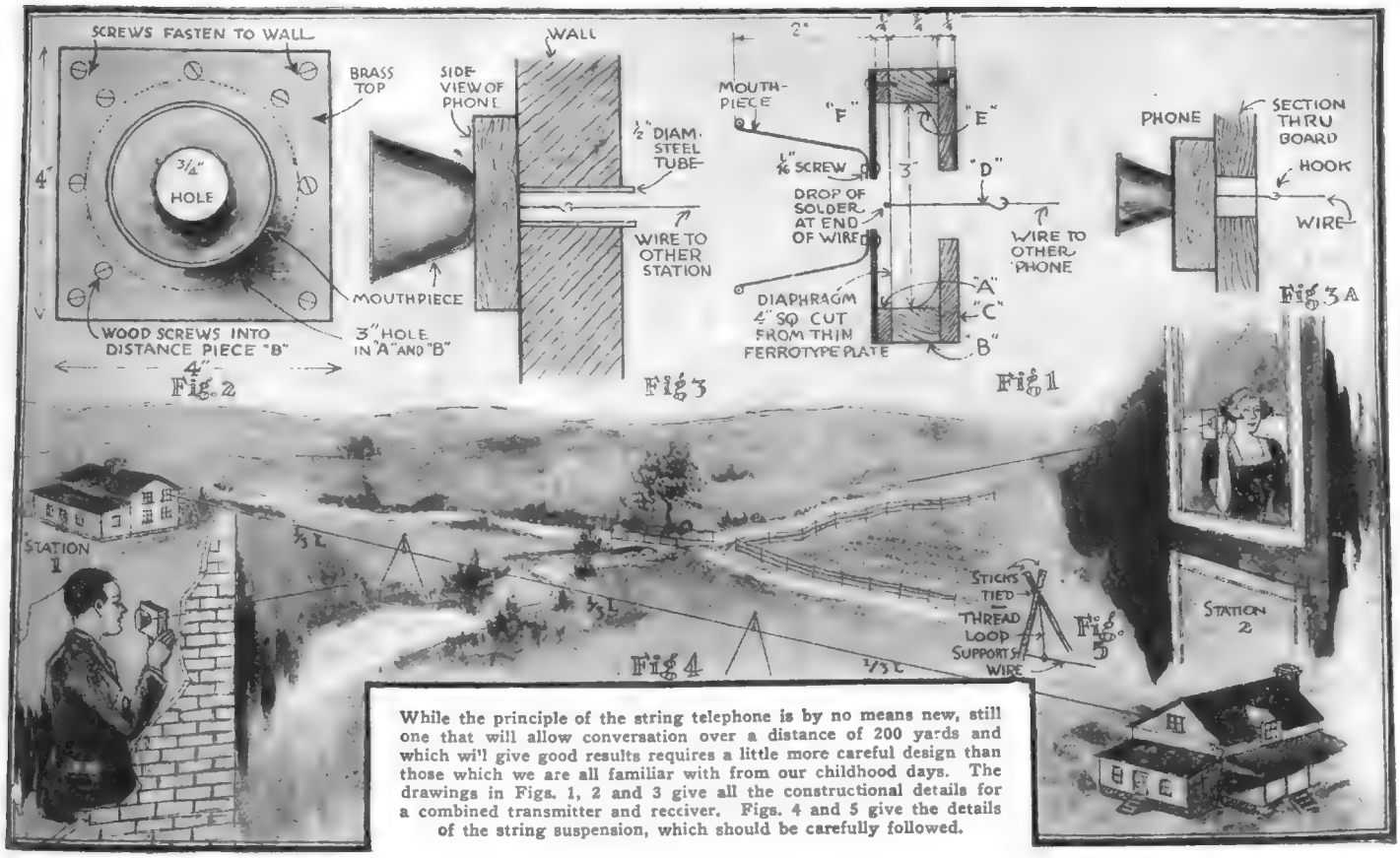
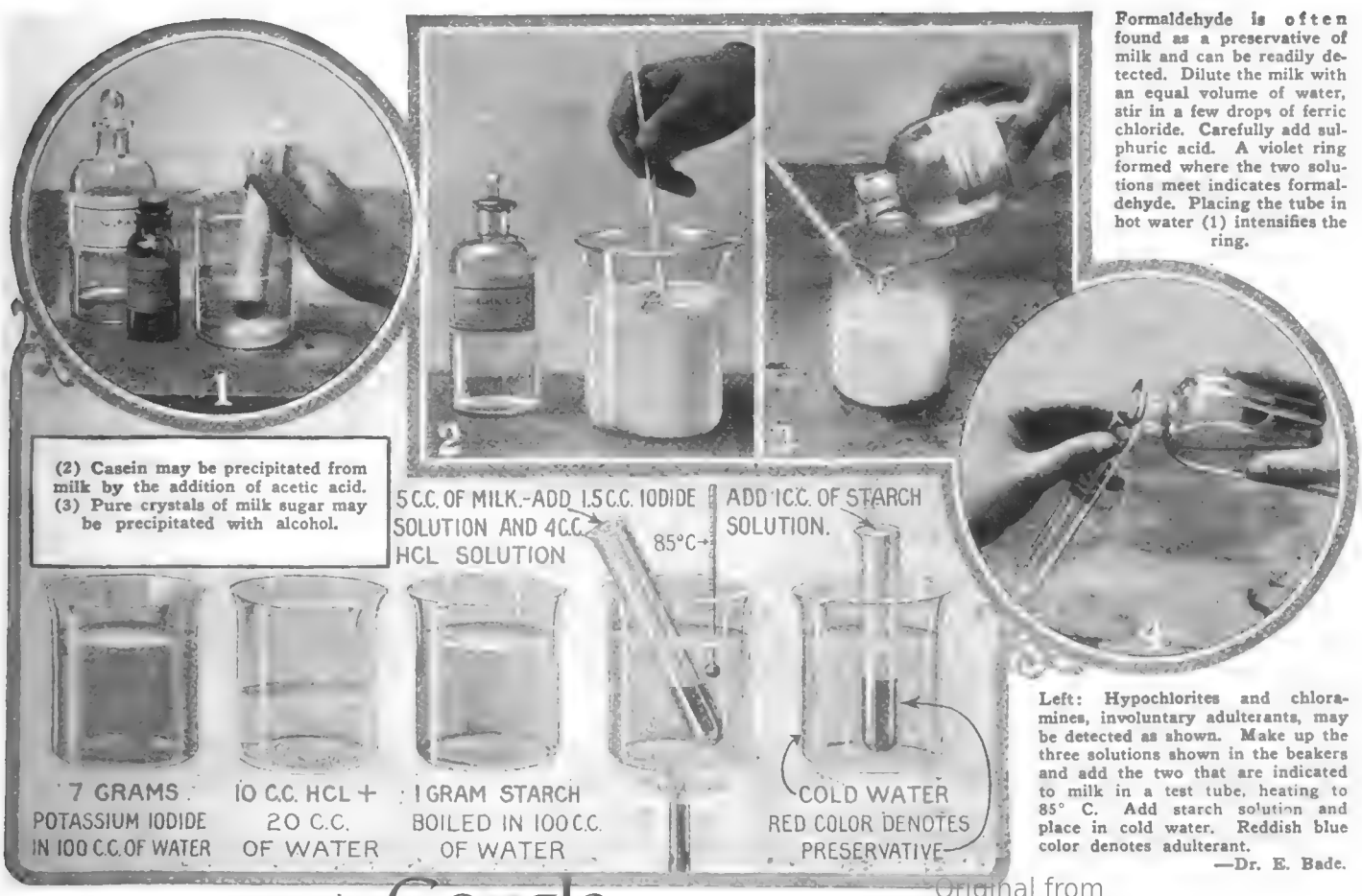
Improved String Telephone

By C. A. OLDROYD



While the principle of the string telephone is by no means new, still one that will allow conversation over a distance of 200 yards and which will give good results requires a little more careful design than those which we are all familiar with from our childhood days. The drawings in Figs. 1, 2 and 3 give all the constructional details for a combined transmitter and receiver. Figs. 4 and 5 give the details of the string suspension, which should be carefully followed.

Testing Milk


1
2
3
4
5 C.C. OF MILK.-ADD 1.5 C.C. IODIDE SOLUTION AND 4 C.C. HCL SOLUTION
85°C
ADD 1 C.C. OF STARCH SOLUTION.
7 GRAMS POTASSIUM IODIDE IN 100 C.C. OF WATER
10 C.C. HCL + 20 C.C. OF WATER
1 GRAM STARCH BOILED IN 100 C.C. OF WATER
COLD WATER
RED COLOR DENOTES PRESERVATIVE

Formaldehyde is often found as a preservative of milk and can be readily detected. Dilute the milk with an equal volume of water, stir in a few drops of ferric chloride. Carefully add sulphuric acid. A violet ring formed where the two solutions meet indicates formaldehyde. Placing the tube in hot water (1) intensifies the ring.

(2) Casein may be precipitated from milk by the addition of acetic acid. (3) Pure crystals of milk sugar may be precipitated with alcohol.

Left: Hypochlorites and chloramines, involuntary adulterants, may be detected as shown. Make up the three solutions shown in the beakers and add the two that are indicated to milk in a test tube, heating to 85° C. Add starch solution and place in cold water. Reddish blue color denotes adulterant.

—Dr. E. Bade.

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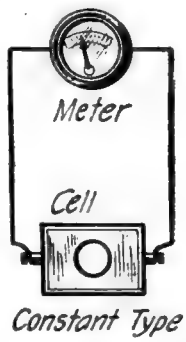
Current-Producing Selenium Cells

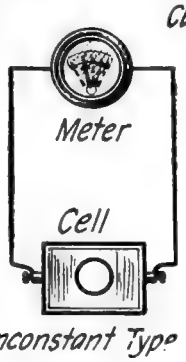
Their Dependence On Moisture.

By W. S. GRIPENBERG, Selenium Cell Specialist



Constant Type

Fig. 1



Inconstant Type

Fig. 2

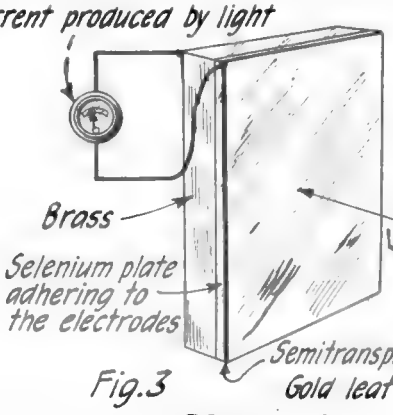


Fig. 3

FRITTS CELL

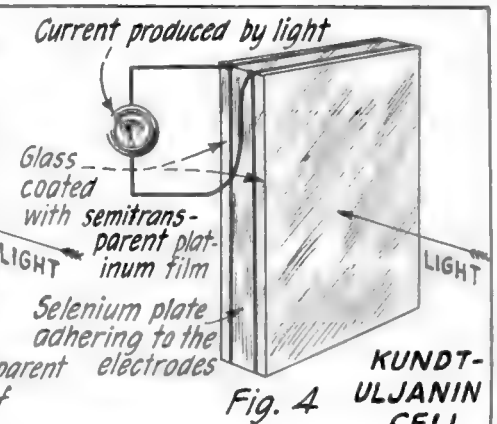


Fig. 4

KUNDT-ULJANIN CELL

Experiments conducted by the author which covered several months of research work with the various types of cells illustrated herewith have shown that selenium cells depend upon moisture for their action.

Two very sensitive types of selenium cells which produced currents when exposed to light.

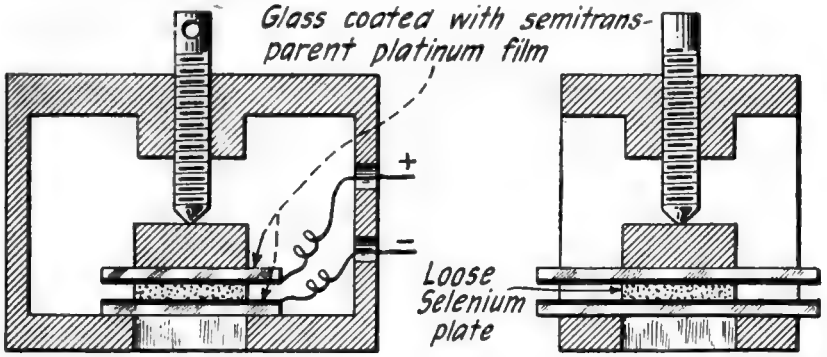


Fig. 5

GRIPENBERG CELL

One of the experimental types of selenium cells particularly adapted to the moisture experiments is shown above.

The loose selenium plate in the Gripenberg cell was first inserted in the frame and tested. It produced a current. The plate was then heated to remove the moisture.

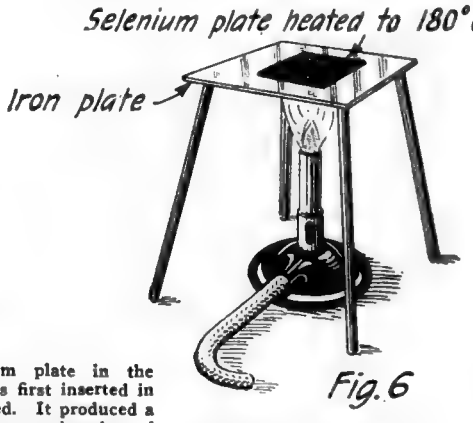
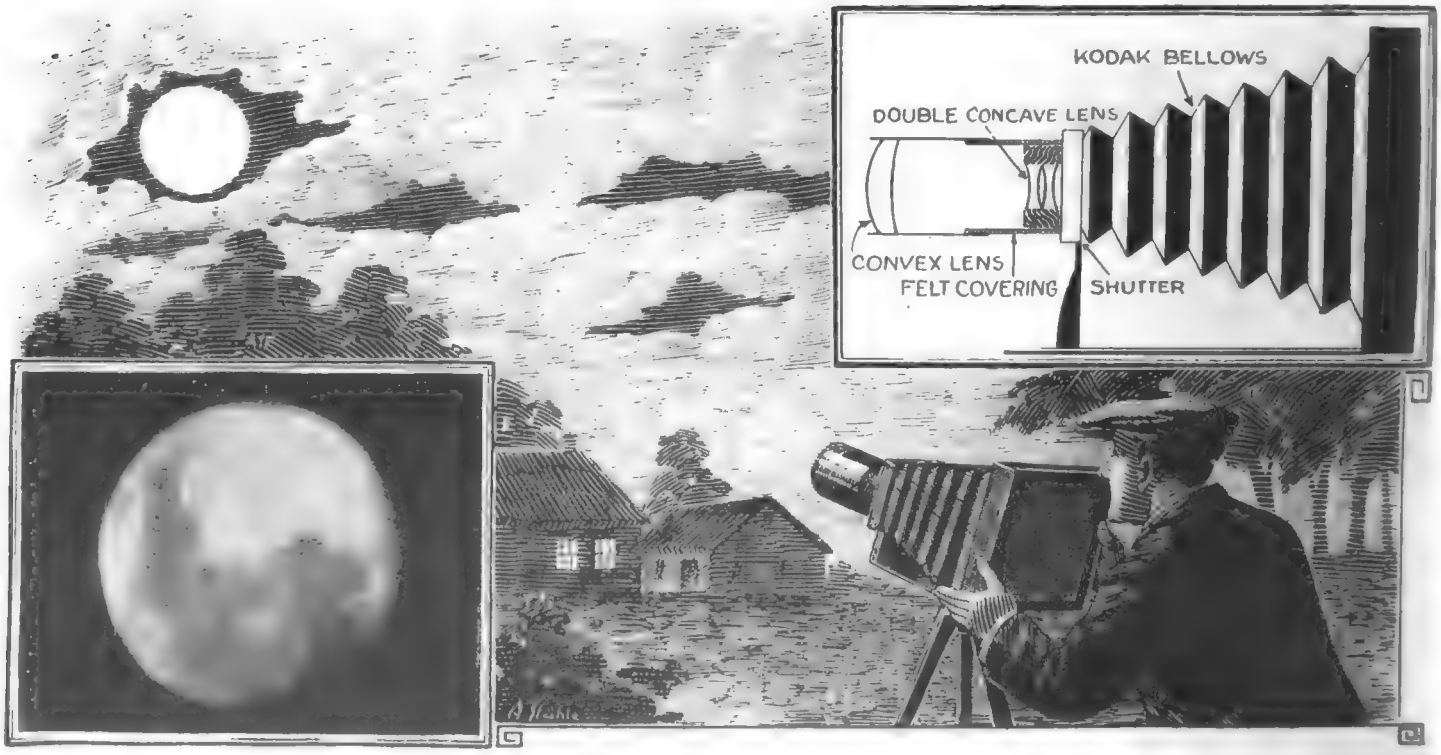


Fig. 6

The heated plate, when replaced, gave no current.

Celestial Camera



A camera attachment for taking photographs of the heavenly bodies may readily be made as shown above. A tube with a focusing arrangement is first provided and fitted at one end with a convex lens. A double concave lens is placed in the other end in the manner shown. By setting the camera on a rigid tripod, focusing and experimenting with the length of exposure, excellent results can be obtained.—Left—moon. —C. B. Johnson.

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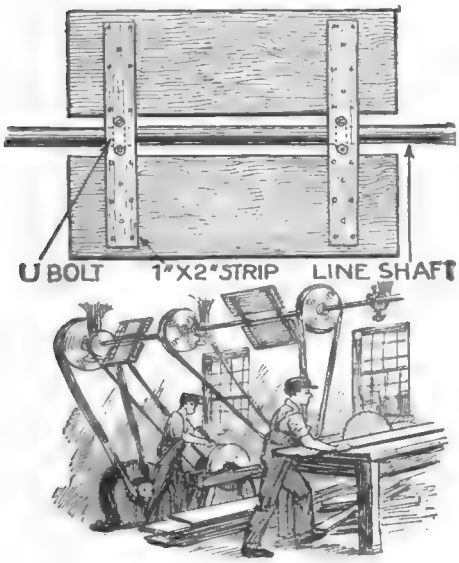
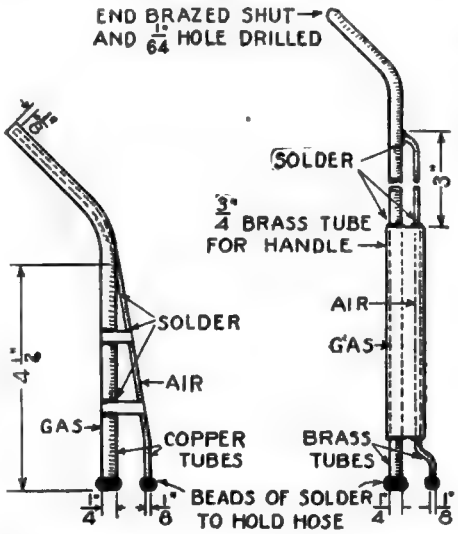
HOW-TO-MAKE-IT

Shop Fan



A fan for use in machine shops may be quickly and easily made as shown above. It is to be clamped on a line shaft and will give excellent results with a very low power consumption.
—E. L. Edwards.

Torches

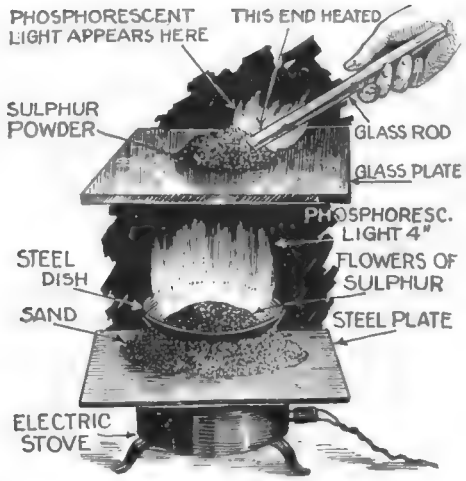


LOW PRESSURE TORCH FOR BATTERY WORK ETC.

HIGH PRESSURE TORCH FOR BRAZING ETC.

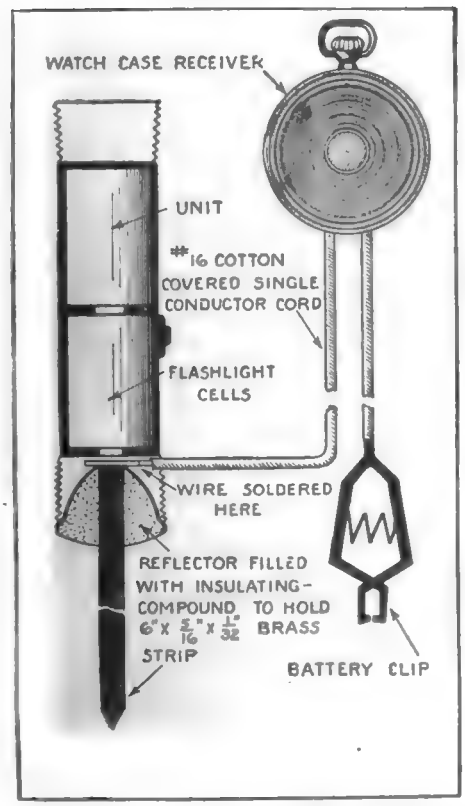
Torches for high and low pressure use may be made as shown above at the right and left respectively with brass or copper tubing. Rubber tubes lead to the tanks.
—K. B. Thompson.

Phosphorescent Light



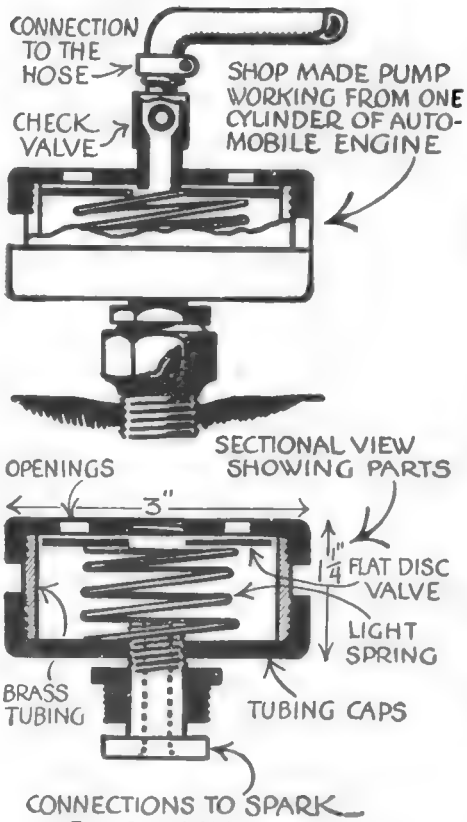
Two interesting chemical experiments in the production of phosphorescence are illustrated above. Sulphur, when heated by any of the two methods illustrated, produces a very weird luminous effect. For all experiments in phosphorescence the room should be quite dark.
—C. A. Oldroyd.

Test Set


WATCH CASE RECEIVER
UNIT
#16 COTTON COVERED SINGLE CONDUCTOR CORD
FLASHLIGHT CELLS
WIRE SOLDERED HERE
REFLECTOR FILLED WITH INSULATING COMPOUND TO HOLD 6" x 5/16" x 1/32 BRASS STRIP
BATTERY CLIP

For use on all kinds of electrical apparatus and radio sets, the above illustrated tester gives excellent results. Two flashlight cells in a reconstructed case furnish power. The watch case receiver is the detecting element.
—W. B. Clark.

Tire Pump



The simple tire pump illustrated above is attached to a spark plug shell. The shell is screwed into one cylinder in place of the plug and the engine operated when a tire is to be inflated.
—G. A. Luers.

Train Speed

When traveling on a railroad train, one often wishes to know just how fast he is traveling. Here is a method that is much quicker than timing the distance between mile posts and which is of use during day or night. Merely count the number of clicks heard as the wheels of the train pass from one rail to the next in 20.4 seconds. This number will be the speed of the train in miles per hour.
—Elliot R. Weyer.

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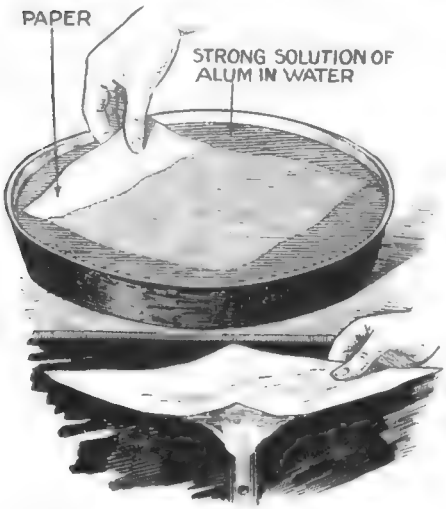
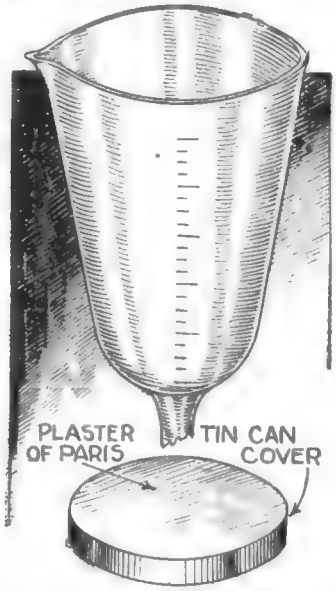
WRINKLES
RECIPES & FORMULAS

Fire-Proof Paper



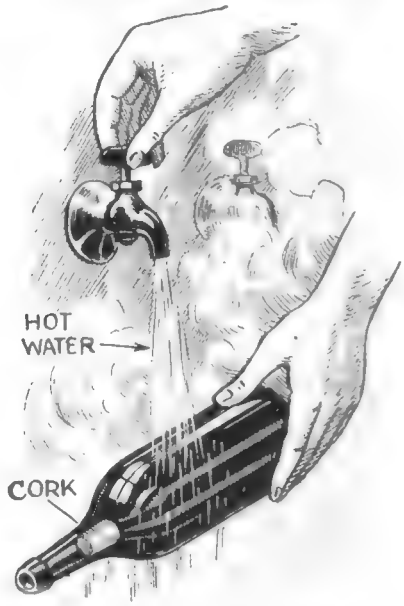
Paper which will not burn when held in a flame is often desired for various purposes. Ordinary paper may be used in this way by saturating it three times in a strong solution of alum in water, drying it after each saturation. —F. S. Yamamoto.

Graduate Repair



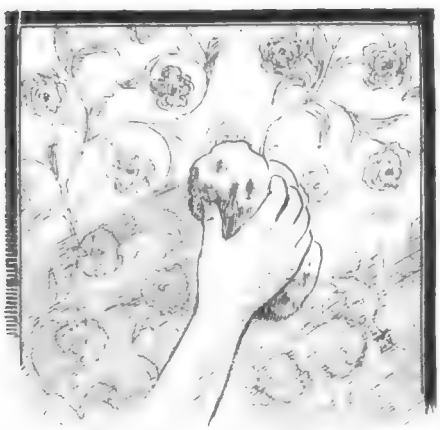
When the base of a graduate breaks, a sturdy repair may be made as illustrated above. The plaster will hold the graduate rigidly. —Joe Windle.

Removing Cork



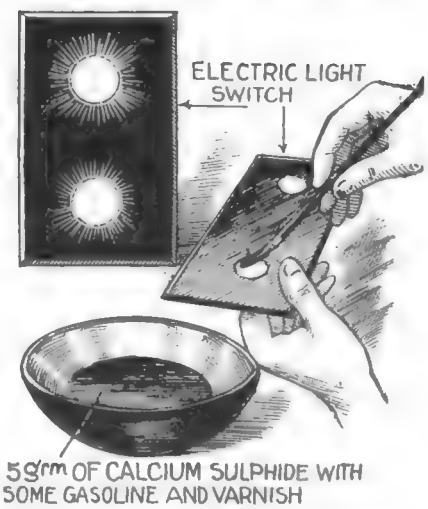
Get the cork to the mouth of the bottle as shown. Applying hot water will usually force it out. —Robert G. Nicholl.

Cleaning Paper



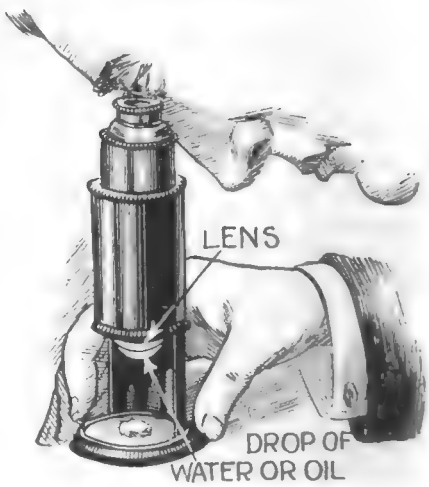
Soiled wall paper may be quickly and easily cleaned by stroking lightly and in one direction only with a mass of dough made up of bread flour and water to a consistency that will not stick. Never go over the same place twice. —Mrs. Jean Wagar.

Luminous Switch



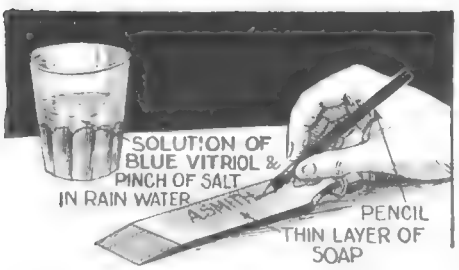
A mixture as described above makes luminous paint for application as shown. —Claude G. Minnich.

Microscope



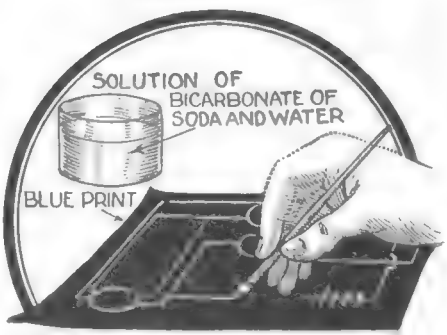
The power of a microscope may be improved by placing a drop of oil or water on the objective as shown above. —L. M. Brooks.

Metal Etching



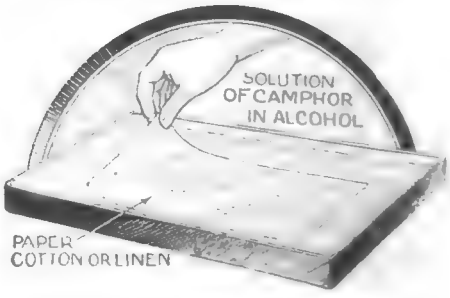
Coat the metal to be etched with soap and scratch the marking through the soap to the metal with a pencil. Apply blue vitriol solution. In about five minutes, wash it off. —E. C. Tinlick.

Blue Prints



White lines may be drawn on blue prints with the solution shown above.—A. A. Blumenfeld.

Transparent Paper



Transparent paper for various uses may be made by immersing cotton or linen paper in the solution indicated above. —F. R. Moore.

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Readers Forum

READING BACKWARDS

Editor, SCIENCE AND INVENTION:

When I read Mr. Ringstrom's idea of beginning books at what is now the back, I thought of an explanation for a reader starting the book in this way. A right handed person naturally begins to turn the pages with his right hand. The pages slip over easier with the palm of the hand toward the book and the thumb, letting them spring open one by one. This places the right thumb at the back of the book. When turning in this manner, the advertising is read (or passed over) first. This suits me all right. Better have a bad beginning and a good ending than an interesting start and end in some "ads" with no more hope until the next month. I do not think Mr. Ringstrom's plan would be popular because it would be hard to become accustomed to look to the left for the next page when we are used to looking to the right. It would also be awkward reading to the right and turning to the left. Turning to the left and reading to the left would be worse. ?os kniht uoy t'noD (Looks a little queer, eh?)

EDWARD C. JOHNSTON, Pittsburgh, Pa.

(You are right in assuming that a right-handed person naturally begins to turn the pages of a book over with his right hand, and it is much easier to hold the entire book in the left hand and turn the pages with the right, but begin turning with pages nearest the hand turning them, viz., the back of the book; at least that seems to be the case with the majority of right handed individuals, and if you care to observe the readers of newspapers, you will find that this is their general procedure. The reason for this may lie in the fact that a great many of the newspapers have their comic and magazine sections near the end of the paper, i. e., on the last, next to the last, or third from the last sheets. Business men and women enjoy comics, some of them to a greater extent than they do the heavy news, and it may be that they unconsciously turn toward the end of a book due to force of habit in handling newspapers. Of course, printing a book backward would not be a good system, and, as you say, reading type from right to left is infinitely worse.—EDITOR.)

BENDING LIGHT RAYS

Editor, SCIENCE AND INVENTION:

It seems that if the new quartz lens which will make a beam of light turn a hundred and eighty degrees angle be mounted in a telescope, one could see objects miles away in the same plane as that of the eye. This would be of great benefit to the police department because the escaping bandit could be watched by means of the telescope, even though the bandit is around the corner several blocks away. The light would pass through a wide arc from the bandit's automobile over the high buildings to the telescope. Then radio equipped motorcycle cops could trap the bandits. Instead of looking at distant planets with a telescope, ships could be watched across the ocean, even though they could not be seen with an ordinary lens because of the curvature of the earth. If a common lens can gather light rays from a planet millions of miles away in a vacuum, why could not a ship be seen a few thousand miles in this denser air with a quartz lens?

THERREL J. SNYDER, St. Johns, Mich.

(Your impression concerning the operation of a quartz lens is distorted. Although a light beam can be made to follow a curve by means of a quartz bent cylinder, the quartz operates, not by refraction, but by internal reflection. In other words, if we desire to bend the beam of light through 180 degrees of a semi-circular arc, we have to have a quartz bar or cylinder curved through such arc. The light is bent along the interior of this solid quartz glass rod and will take the curvature of the rod. The instant the beam reaches the end of the rod, it emerges and goes through the atmosphere via the ether in a straight line. Consequently, in order to make a telescope which will "look around the corner," the telescope would have to have a long glass rod bent through an arc of 90 degrees, and it would have to be so situated that the bend would be located at the corner around which the observer desires to see, and in order to observe a ship crossing the ocean, it would be necessary that the lens be long enough to make such an observation practical. Such a telescope would have to be approximately three miles long to see the ship when it is hull-down for an observer at sea level.—EDITOR.)

INTELLIGENCE OF FISH

Editor, SCIENCE AND INVENTION:

The September issue of SCIENCE AND INVENTION contains a drawing of an eel in a bath tub. The eel has its tail around the water outlet on the tub and is holding the water in. The picture is entitled "Intelligence of Eel." Under the drawing is the following: "Kosmos, a German scientific journal, quotes an observation made by one of their readers which would seem to point to a more than usual degree of intelligence found in an eel. When the stopper of the bath tub in which he was living was removed he took care to preserve his life by using his tail as a dam as shown."

I wish to take exception to the statement that the eel shows intelligence and that he intentionally dammed up the water. In the first place, when the stopper is removed from a bathtub full of water, the water runs out. While running out it creates a small whirlpool or suction around the outlet. I believe that the eel's tail was drawn around the outlet by the suction of the water and was not put there by the eel. Perhaps we can explain the position of the eel's tail by saying that it was due to the unusual degree of intelligence found in the water in the bath tub while it was running out. I have never found anything but bones in fishes, and I think the eel is no exception. If the eel had any intelligence, would it be in the bath tub? No, it would be in some creek where there was no danger of the water leaking out. Even at that, the eel showed more intelligence than the man who put it into the bath tub. What is becoming the matter with those scientific Germans? But the eel's intelligence is nothing to the intelligence of a pet snake I once had. I once found a small garter snake and put it into a bottle. I put a cork in the bottle, ran a string through the cork and knotted it on the inside of the bottle. I then hung the bottle up by the string. The snake became restless and then stopped its crawling around inside of the bottle and was motionless. I watched it closely and I saw it raise its head, take a look at the knot, then look at the floor. It then got hold of the knot with its mouth and pulled. The knot came unfastened and the bottle fell to the floor and broke. The snake then crawled away and disappeared into a rat hole before I could catch it again.

N. COMPTON, Greenville, Ohio.

(The suction created by water flowing out of a bath tub is certainly not strong enough to cause an eel to curl around the outlet of a bath tub, as indicated in the article above alluded to. The muscular structure of an eel is very powerful and could easily overcome the "suction" in question. There is considerably more than "just bones" in an eel. As a matter of fact, the structure of an eel is highly organized, its digestive organs being complete. A brain is found, and nerves, spinal cord, heart and blood vessels are all in evidence. It would take too long to describe the structure of an animal of this nature, but a good book on biology would not be a bad suggestion. The writer of the above communication evidently gives greater credit to a garter snake than to an eel. We certainly would question the authenticity of the snake episode or the ability of an animal to untie knots. We will guarantee that no garter snake living would untie a knot which we tied. There are times when we can't do it ourselves. We wonder if it was a bowknot.—EDITOR.)

SCIENCE AND INVENTION desires to hear from its readers. It solicits comments of general scientific interest, and will appreciate opinions on science subjects. The arguments pro and con will be aired on this page. This magazine also relishes criticisms, and will present them in both palatable and unpalatable forms. So if you have anything to say, this is the place to say it in. Please limit your letters to 500 words and address your letters to Editor—The Readers Forum, c/o Science and Invention Magazine, 53 Park Place, New York City.

The Experimenter

has come back! If you are one of the one hundred thousand readers of the old ELECTRICAL EXPERIMENTER, you will no doubt be glad to hear that the EXPERIMENTER is coming back BIGGER AND BETTER THAN EVER. PRACTICAL ELECTRICS has been changed into an entirely new kind of magazine entitled

The Experimenter

In this magazine which has been greatly enlarged in point of contents, illustrations and circulation, you will find the following new departments:

Experimental Radio
Experimental Chemistry

There is an entirely new treatment of radio containing experiments only. *90% of the magazine contains pure experiments* written by the foremost authorities in their respective fields, also a monthly editorial by the writer.

A fine roto-gravure section is now added to brighten up the magazine. *If you want experiments, this is your magazine.*

Be sure to reserve a copy from your news-dealer before the issue is sold out. THE EXPERIMENTER will be on sale at all newsstands beginning February 20th, 1925.

Hugo Gernsback
Editor

THE SPIRIT QUESTION

Editor, SCIENCE AND INVENTION:

In looking through one of the back numbers of your magazine (December, 1923), I noticed you have conducted a test on the genuineness of spiritualism, and to ascertain the source and cause of the so-called phenomena. I am very much interested in knowing the results of the tests conducted by your staff of investigators, as I have been troubled at night by strange phenomena in my room, such as knockings and table moving. On such occasions many times when I attempted to quickly turn on a light, I found to my disgust and terror that the bulb had been unscrewed from the socket and was, as near as I could tell, dangling in the air some place near the socket. Will you kindly have one of your staff furnish me with a report?

G. W. ALEXANDER, Chicago, Ill.

(The phenomena of which you write are certainly unusual, and it will be interesting to investigate them. We have seen no demonstrations of psychical phenomena which were not fraudulent. We are still looking for them, and our $11,000.00 award has not yet been earned by anyone. We have condemned so-called procedures of alleged psychical performers as being willingly fraudulent. The fact that no so-called "spiritualists" have come forward to demonstrate their capabilities tends to verify this conclusion. We would suggest that you purchase a flashlight, seal it and make use of this when you think there are others in the room moving tables or doing various other tricks. Spirits ordinarily will not break seals.—EDITOR.)

PLAGIARISM

Editor, SCIENCE AND INVENTION:

As one of your reporters I am writing this letter as a sort of protest against these fellows who are sending you in "old stuff," as the saying goes, and passing it off on you as original matter and getting away with it too and just think of the money prizes you are paying out to make SCIENCE AND INVENTION one of the most popular and interesting of magazines. I hate to see this sort of thing being pulled off while a lot of the rest of us are striving to send you really new and interesting materials.

Take, for example, the prize of $10.00 you paid to Fred Ayres and another to Gus Oline for the articles you published in this October issue on page 586. I know both of these to be old and not original. I knew the idea of converting one of the long copper-covered can openers into a coarse sewing needle was old, and that I had seen it published three or four years ago; and also the idea of passing a small machine screw through a piece of paper to hold it while setting the screw within some difficult place, so I took the trouble to look them up to convince you I am correct in my statement. I could not locate the article about the screw, but was able to find the one about the can opener, which I inclose for your guidance. It was published in March, 1921. I think such correspondents as these should be dropped from your rolls and requested to return the prize money they have accepted, unless they can prove in some manner or other that they are entirely innocent and believed they were sending original matter. I have had occasion to invite the attention of the publishers of another magazine to some of the same class of contributors who were sending in old matter, and they were promptly dropped by the editor who wrote and thanked me for calling his attention to their methods. I think it is only right to endeavor to protect those of us who are striving to send you interesting new material. While on the other hand you are publishing and paying out money for old material such as I have pointed out.

LEIGHTON POWELL, San Francisco, Calif.

(As will be noticed, Mr. Gus Oline received no prize for his article. We have every reason to believe that Mr. Fred Ayres did not attempt to copy the article which you found originally in another publication. If Mr. Ayres has done this intentionally or purposely, we will make it our duty not to accept further manuscripts from him. We believe, however, that Mr. Ayres is absolutely sincere in the belief that the article was original. We have no use for plagiarism and always fight against it when we can do so. Of course, occasionally a man will unintentionally plagiarize another article, and particularly if it is short, one cannot quite hold him materially responsible for doing so. If the editors know that an article of a certain type has been published before in another periodical, a rejection slip is immediately clipped to the article, and the reason for its rejection is marked on the slip.

Nevertheless, we thank you very much for calling this matter to our attention, and we will be indebted to any of our other readers who bring proof of plagiarized articles to our attention at any time.—EDITOR.)

(*Continued on page* 1143)

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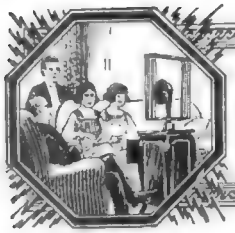
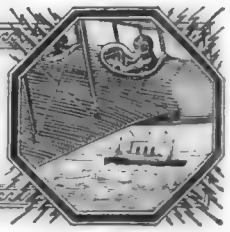


RADIO

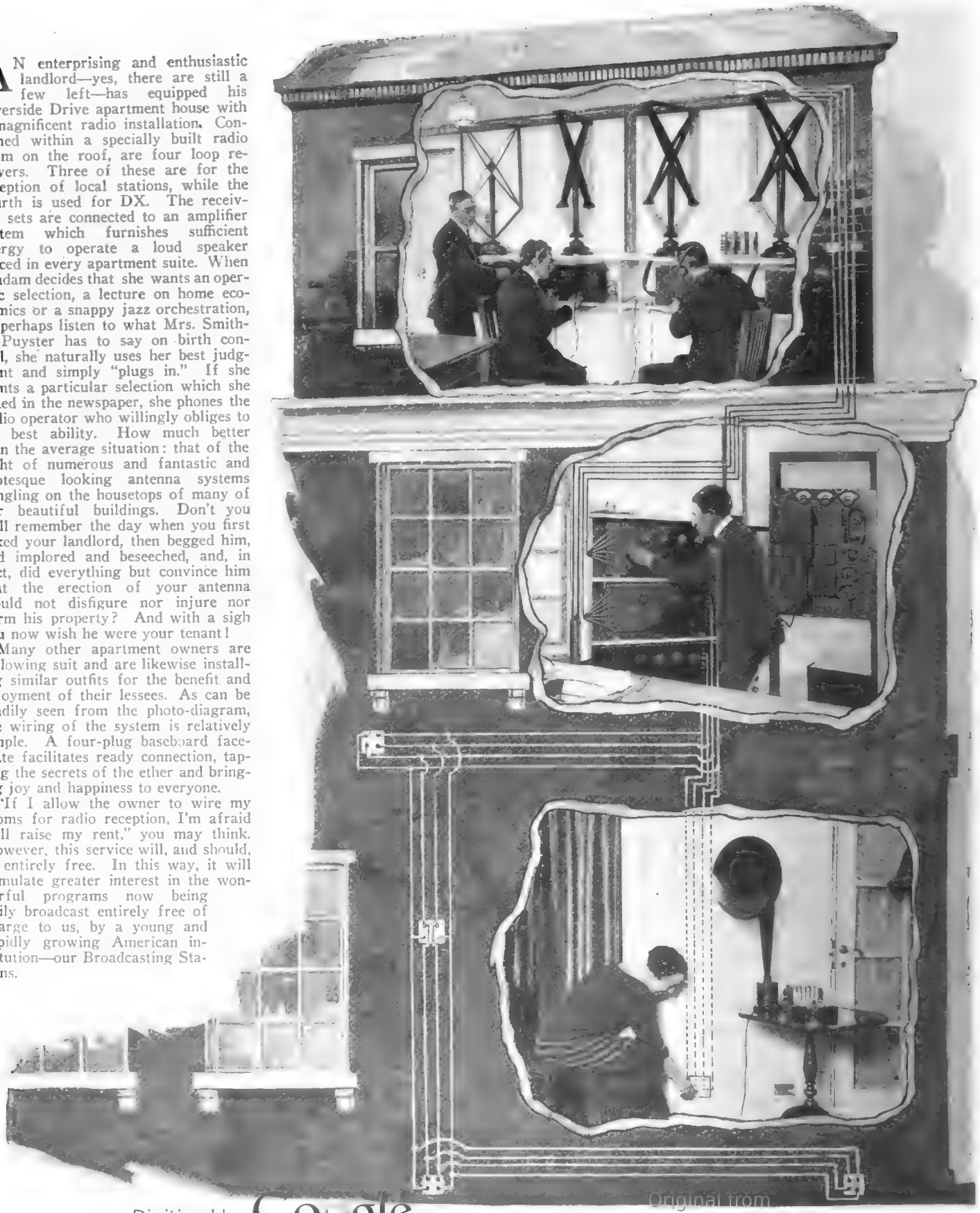


Apartment House Radio

AN enterprising and enthusiastic landlord—yes, there are still a few left—has equipped his Riverside Drive apartment house with a magnificent radio installation. Contained within a specially built radio room on the roof, are four loop receivers. Three of these are for the reception of local stations, while the fourth is used for DX. The receiving sets are connected to an amplifier system which furnishes sufficient energy to operate a loud speaker placed in every apartment suite. When Madam decides that she wants an operatic selection, a lecture on home economics or a snappy jazz orchestration, or perhaps listen to what Mrs. Smith-de-Puyster has to say on birth control, she naturally uses her best judgment and simply "plugs in." If she wants a particular selection which she noted in the newspaper, she phones the radio operator who willingly obliges to his best ability. How much better than the average situation: that of the sight of numerous and fantastic and grotesque looking antenna systems dangling on the housetops of many of our beautiful buildings. Don't you well remember the day when you first asked your landlord, then begged him, and implored and beseeched, and, in fact, did everything but convince him that the erection of your antenna would not disfigure nor injure nor harm his property? And with a sigh you now wish he were your tenant!

Many other apartment owners are following suit and are likewise installing similar outfits for the benefit and enjoyment of their lessees. As can be readily seen from the photo-diagram, the wiring of the system is relatively simple. A four-plug baseboard faceplate facilitates ready connection, tapping the secrets of the ether and bringing joy and happiness to everyone.

"If I allow the owner to wire my rooms for radio reception, I'm afraid he'll raise my rent," you may think. However, this service will, and should, be entirely free. In this way, it will stimulate greater interest in the wonderful programs now being daily broadcast entirely free of charge to us, by a young and rapidly growing American institution—our Broadcasting Stations.



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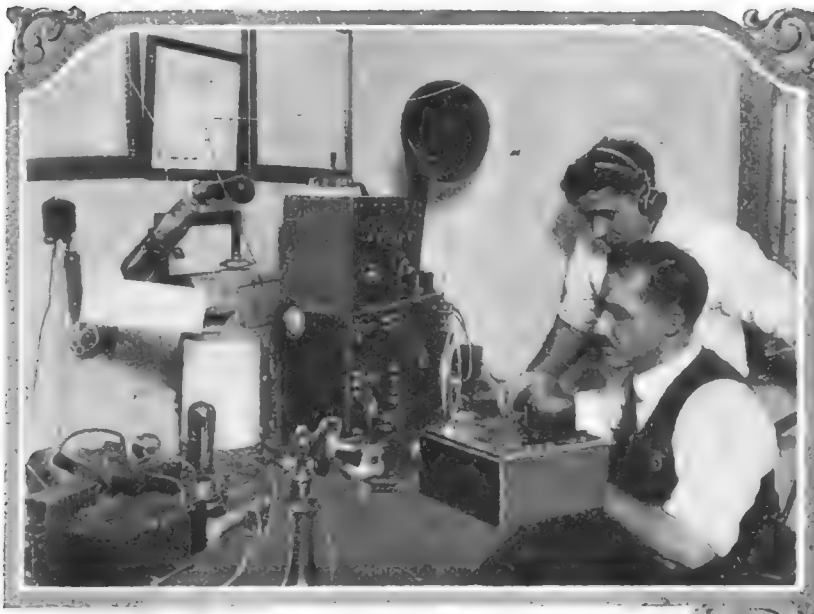
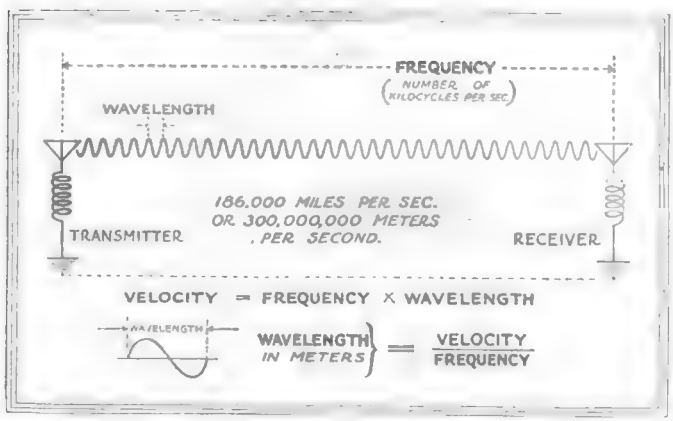
Policemen of the Ether

The Government's Valuable Work



FEW radio fans know that the Federal Government employs radio inspectors to keep a vigilant watch on all broadcast and amateur stations in the country. To attest for it, the above photo shows one of the officers of the law, carefully checking up to see whether there are any errant transmitters on the air. Whenever he does come across one, a note of warning is sent to the offender. A second offense may mean the confiscation of the entire radio apparatus. It is up to the radio inspector to preserve absolute tranquility in the air, a duty which is indeed a difficult task with so many transmitters working. To the right is shown the Bureau of Standards' Radio Traffic Officer who keeps tabs on all those he is able to hear. It may be safely stated that there are very few stations in the country which he is not able to record. Measurements are taken with precision wavemeters.

Not only do the duties of the Radio Inspector require him to listen in, but he must visit the transmitting stations regularly. When on a tour of inspection, it falls to his lot to correct any incursion on the law. Above shows a district radio officer readjusting the transmitter of a broadcasting station whose emitted wave-length differed slightly from that allotted by the government. The discrepancy was not much, but nevertheless it was there. It's the little things that count.



The beginner is somewhat confused as to the real meaning of wave-length, and its relation with the velocity and frequency of radio waves. This point has been fully clarified in the above diagram. Radio waves travel with the speed of light, 186,000 miles per second. By definition, wave-length is the distance between particles in the same phase. Hence, the velocity is equal to the frequency times tne wave-length. Broadcasting stations are assigned between 220 and 575 meters. This means a frequency range of from approximately 1,400,000 to 500,000 cycles per second.

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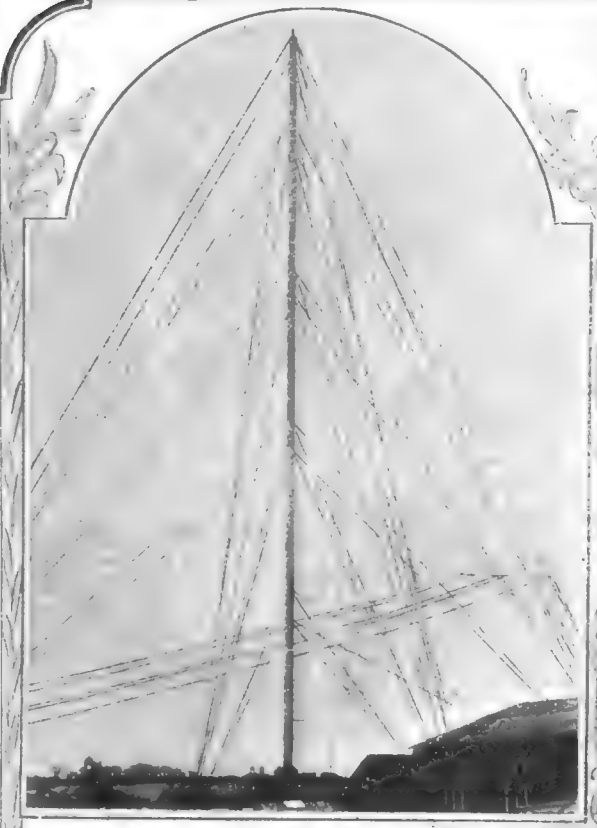
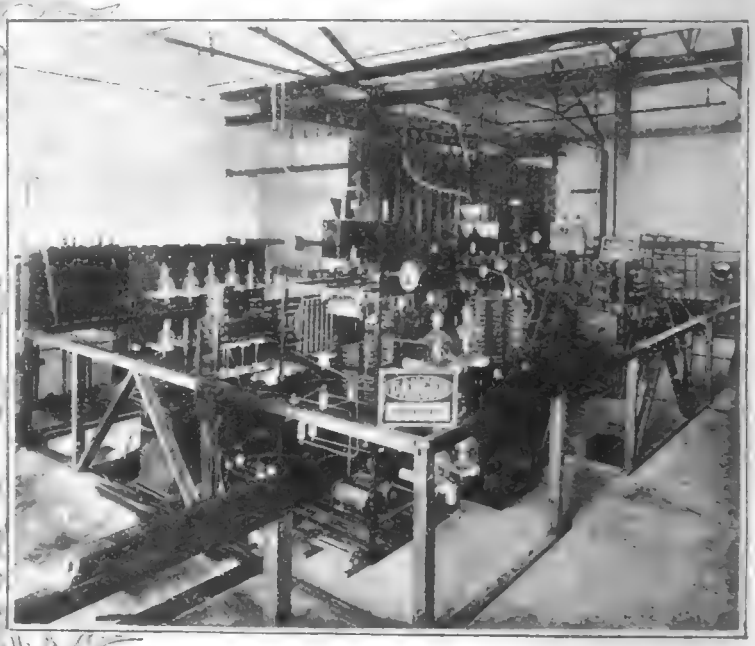
Chelmsford, G5XX

Powerful Broadcast Station at Chelmsford, England.

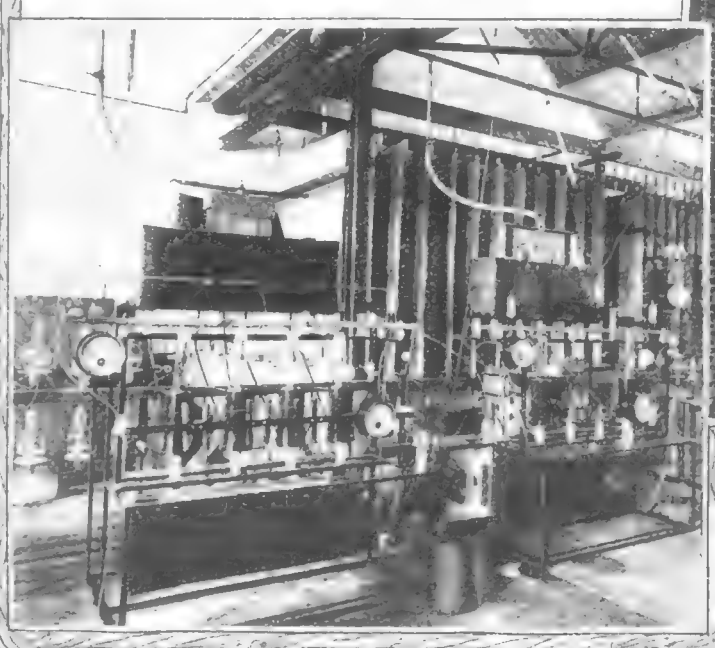
One of the most powerful radio broadcast stations in the world was opened recently at Chelmsford, England, and is now known as G5XX. Operating on the high wave of 1600 meters with a 25-kilowatt input (sufficient to light nearly 4,200 sixty-watt lamps), the station has already been brought to the fore and into prominence through its repeated trans-oceanic transmissions. For the first time in the history of broadcasting, special programs will be sent to America daily and it will be but a matter of a few months before an exchange of programs will take place.

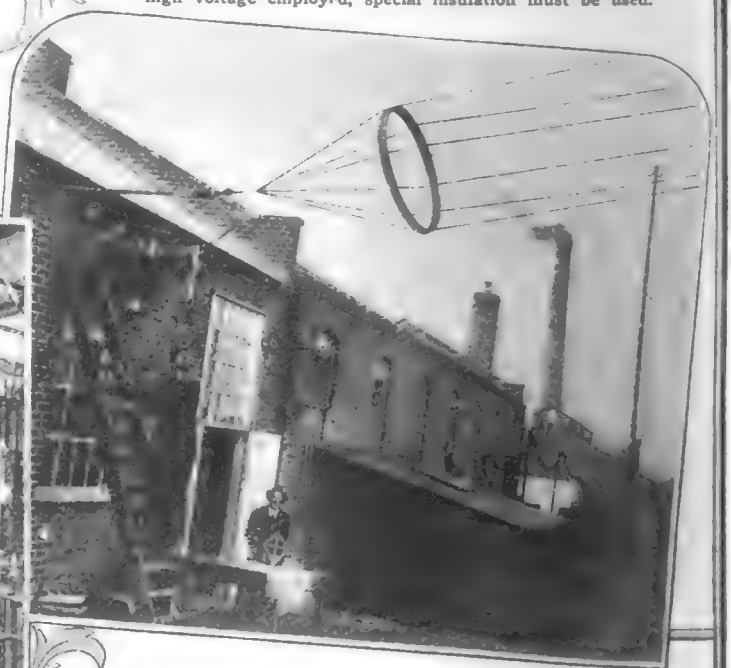




In comparison with the most powerful broadcast stations in the United States, which use but a meager 1500-watt input, Chelmsford is more than 15 times as powerful and should be heard with ease by the average five-tube set. Note the special rectifying tubes in the above photo. Due to the extremely high voltage employed, special insulation must be used.

One of the great 400-foot masts with the immense net work of guy wires, antenna system and counterpoise standing towering up into space. It will be noted that the construction differs from those in this country in that the masts are not self-supporting. Thus, the most powerful station in the world, located at Rocky Point, WQK, uses self-supporting masts which extend to the dizzy height of 600 feet. Below can be seen some of the special high tension transmitting apparatus whose design also vastly differs from ours. This assemblage represents a step towards super broadcasting, a condition which does not meet with favor in the eyes of the American public. Note the multiplicity of meters, power tubes, condensers and connecting wires.





The cage type lead-in connected to a gigantic wall insulator is shown above. Extra precaution was taken in the construction of the antenna system since even a small leak would result in series loss of energy. The insulators were carefully tested and retested so that the chance for break-down was minimized. In order to keep the antenna resistance low, very heavy conducting wires were used. At night it is possible to see with distinct visibility many points of corona discharge.

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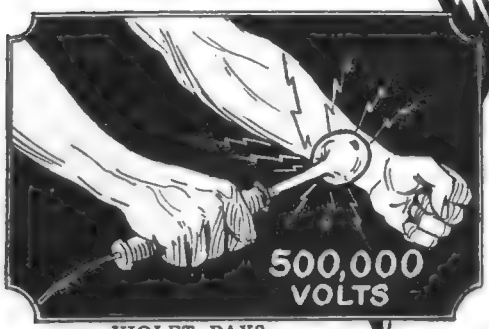
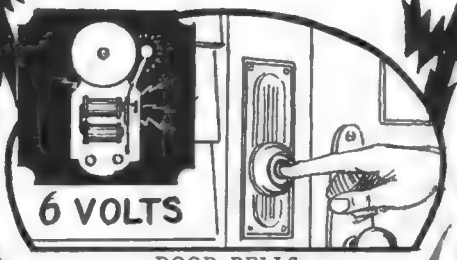
What Causes Radio Interference

Parasites Which Take The Joy Out of Radio



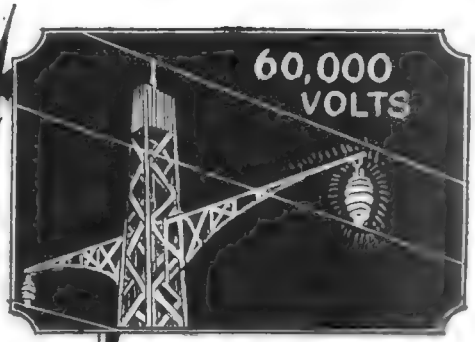
VIOLET RAYS

Your neighbor's violet ray outfit may be the unsuspected cause of the unearthly noises you are hearing.



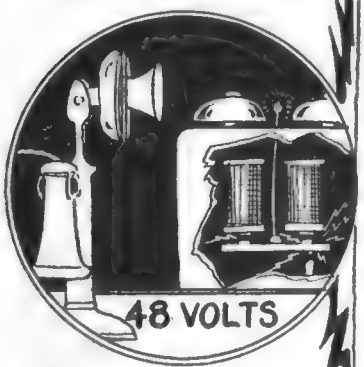
DOOR BELLS

Every time a door-bell in your block is rung you may think that you're receiving Martian signals.



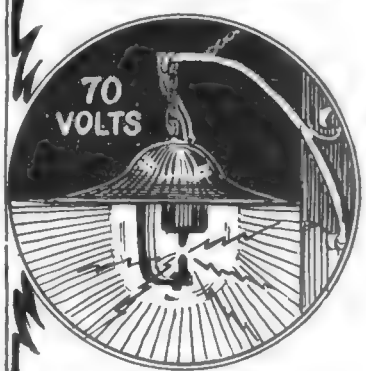
POWER LINES

High tension insulators are apt to leak badly in rainy weather. This is one of the worst nuisances.



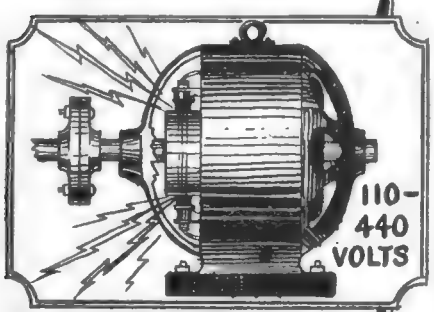
TELEPHONE RINGERS

Reasonable assurance that you are wanted on the telephone—but most of the time it's your neighbor's.



ARC LAMPS

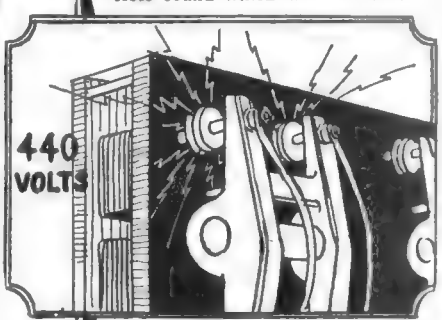
Do you ever suspect the arc lamp on the corner for causing that terrible sound which wont tune out.



MOTORS

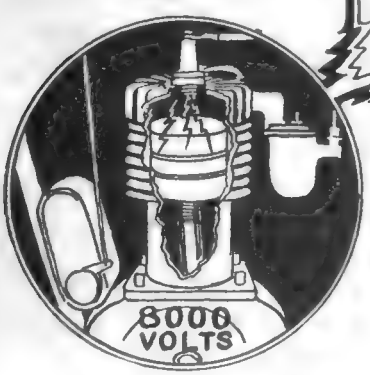
If you are in the vicinity of a factory in which many motors are in constant operation, it's high time to move.

"WOW! WHAT A RACKET. Some static on tonight." Thus you muse and foam and sputter and froth and complain. And then when friend Bill comes around the next day telling you of the wonderful DX he received last night, you stare at him with opened mouth and wonder. Certainly, he exclaims, a better night for distant reception was not had in a long time.—Bill lives over at the other side of the town.—Then the truth dawns upon you. Our artist has shown very realistically most of the causes of interference.



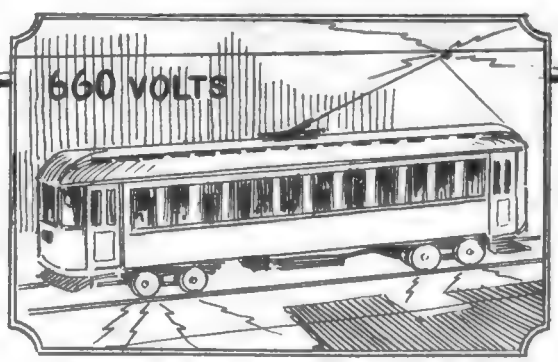
ELEVATORS

If you live in an elevator apartment—not getting too personal now—you might put your radio in a balloon and send it aloft.



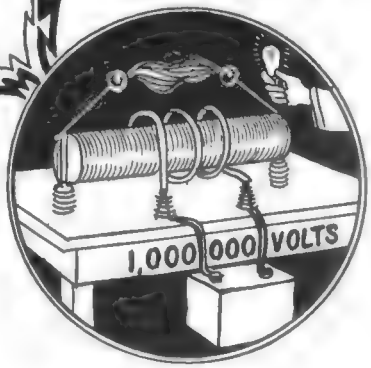
ENGINES

Gas engines, farm lighting plants, and even nearby automobiles are responsible in a great measure for causing you unwarranted exasperation. The sources of such disturbances can easily be traced by the regularity of their ocurrence.



TROLLEY CARS

Did you ever notice an increasing amount of "static" when the street car passed down the block? This source of trouble is difficult to remedy, although by the judicious placing of the antenna or by using a loop, it is possible to overcome it successfully.



H. F. APPARATUS

When little Willie next door starts his new high frequency apparatus going, shut off the set and go out for a walk. This is a situation which you cannot cope with, unless the house current for your section is shut off.

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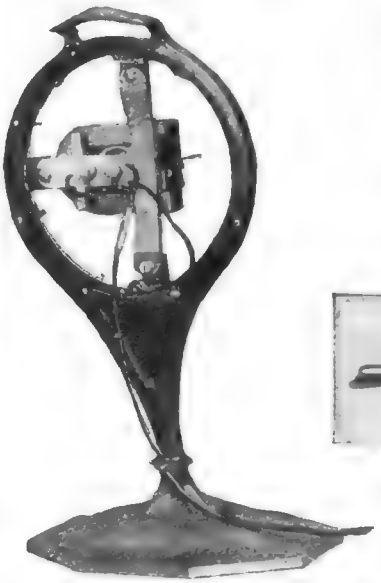
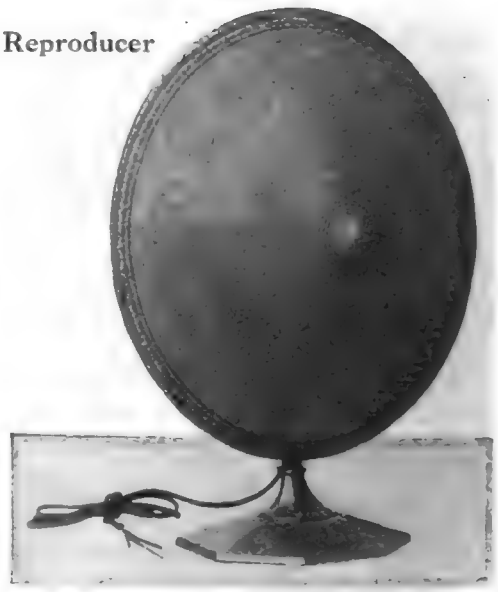
New Paper Cone Speaker

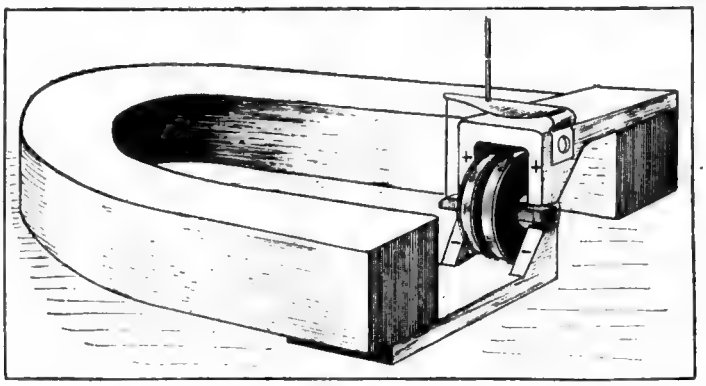
An Exceptionally Fine Reproducer

Witness now the last word in loud speaker design. Decidedly different in every respect from the ordinary horn type of speakers, this one employs a large paper cone specially treated. Note its original features and its radical departure from the average loud speaker. It was found to be able to reproduce the lower musical notes very beautifully.

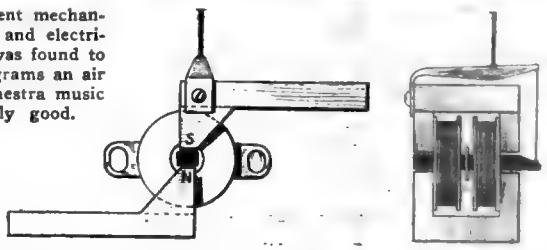




The speaker is of the adjustable type having a small thumb screw which is used to tighten the cone. This is necessary to compensate for the expansion or contraction caused by atmospheric conditions. Note pleasing appearance.

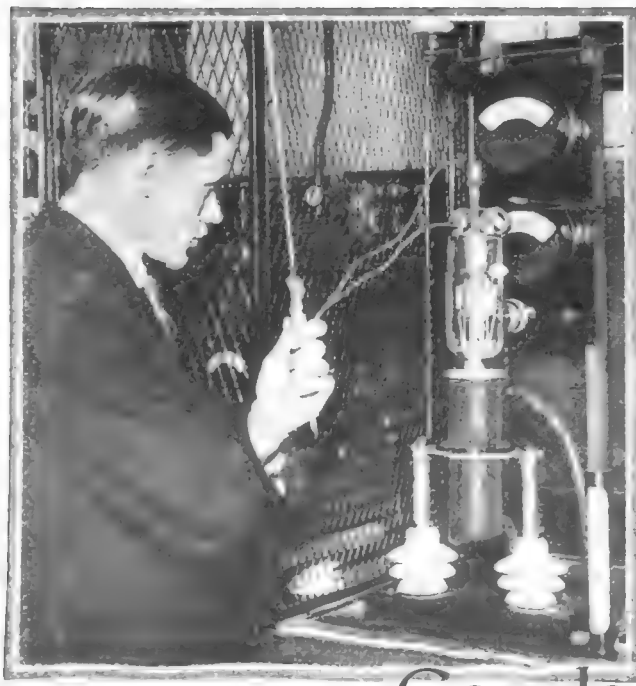


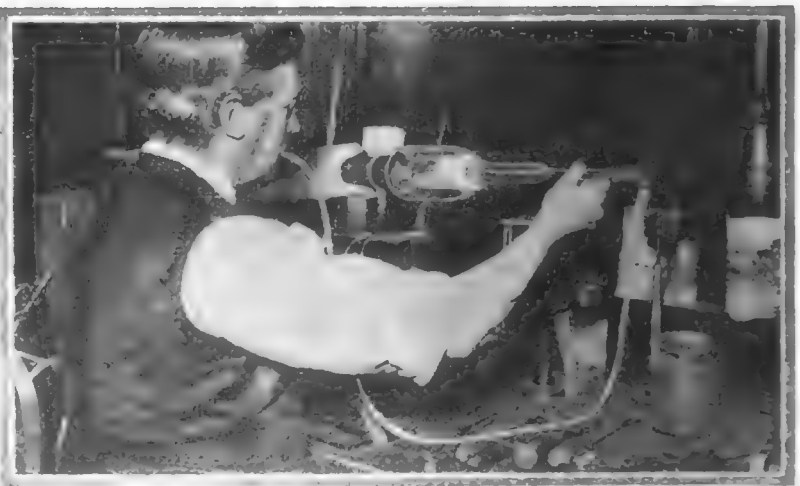
Due to its excellent mechanical construction and electrical efficiency, it was found to give musical programs an air of realism. Orchestra music is exceptionally good.



The above diagrams show how the speaker operates. Suspended between the pole pieces of a powerful permanent magnet is a pivoted armature. Two magnet coils are so arranged as to give maximum movement of the armature to which is attached a small rod which in turn connects to a long pin. This pin actuates the paper cone.—Photos courtesy of the Western Electric Co.

High Power Transmitting Tubes





Here we show stages in the construction of the powerful transmitting tubes used for trans-oceanic communication. The tubes are designed for operation on 10,000 volts and D. C. and in order to withstand the strong current, are equipped with a water cooling jacket. Much of the work has to be done by hand, the photo above showing a step in the sealing of the terminal connections. At left: operator watching the action of the elements under a test of 15,000 volts. At this dangerous voltage, the slightest mechanical jar means disaster to the tube.

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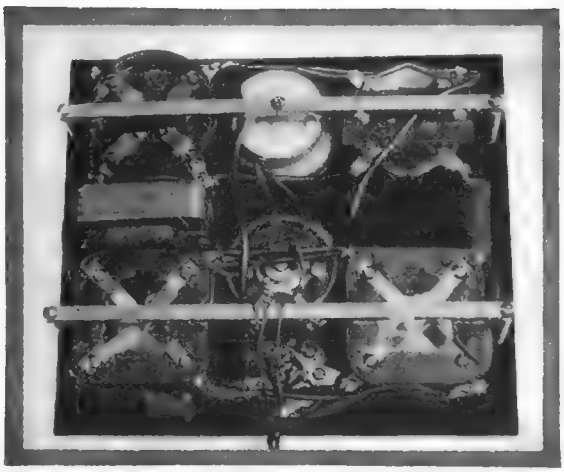
Are You Buying Good Tubes?

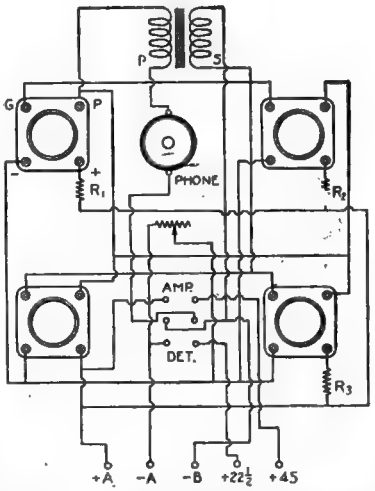
Dependable Tube Testers

By LEON L. ADELMAN, A.M.,I.R.E.

Audio Frequency Oscillator



When you enter a radio store, to buy new tubes for your receiver, do you ask the salesman to test them for you? Are you satisfied when he merely shows you that the filament lights and concludes that the tube must be a good one? You may be misled and are making a mistake. You are entirely within your rights to demand a more thorough test, the instruments shown here, being for that purpose.

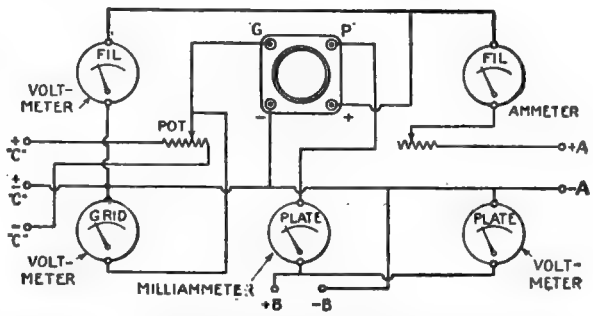


The tube tester shown above allows tubes to be tested for their audio frequency oscillations, it being understood that if a tube will oscillate audibly, it will also do so at radio frequencies. Four different sockets are provided for their respective tubes, and are connected through specific resistances, thus allowing filament operation from one "A" battery source.

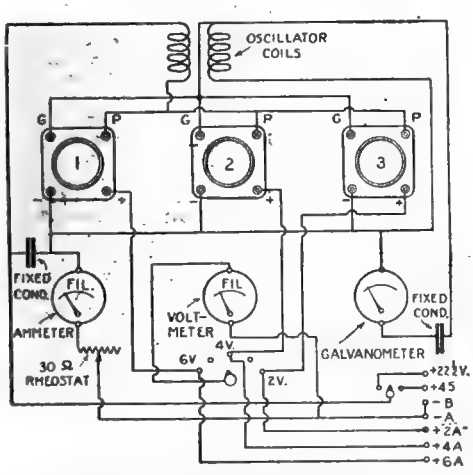
The most important tests in the radio field at the present time are those on vacuum tubes. There is now available a great variety of tubes which have widely varying characteristics. Be careful when buying them and do not take the criterion of low price and exaggerated performance. These standard meters are designed to protect you.

Direct Current Characteristics

The "static" or direct current characteristics of a vacuum tube, if properly checked, are a direct means of ascertaining whether a tube will act at highest efficiency either as a detector, an oscillator, or an amplifier. The instrument shown herewith is readily adaptable for measuring the mutual conductance, the amplification constant and output impedance. Contrary to general opinion, the amplification constant is not the main consideration in a tube, but the mutual conductance should be noted carefully when purchasing them.



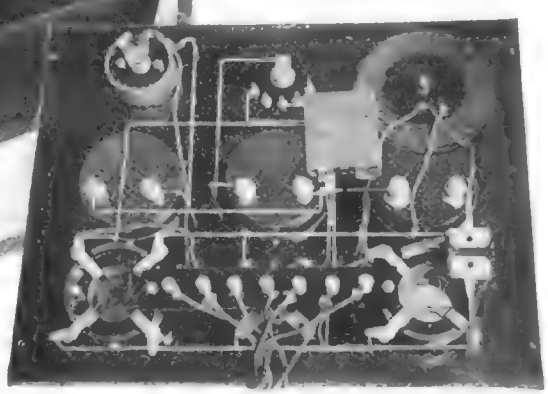
For a given rated "A", "B" and "C" battery voltage, the larger the reading shown by the plate milliammeter, the better the tube. Remember, good tubes mean good results.



The circuit shown above allows any of the standard tubes to be checked. Ask to see the readings on the meters before purchasing.

Radio Frequency Oscillator

Perhaps the surest means of accomplishing the thorough testing of tubes is that of measuring their radio frequency output, at normal input rating. For this purpose, a current-square galvanometer is used in conjunction with a filament, voltmeter and ammeter.



Because of the fact that the three element tube patents expire next year, there is bound to be a large influx of inferior vacuum tubes.—Names of manufacturers of testers will be given on request. Every dealer should have one of these indispensable outfits for the protection of his customers.

Where these meters are not used by a radio store, persist in having the tubes tested in a receiving set, under normal operating conditions.

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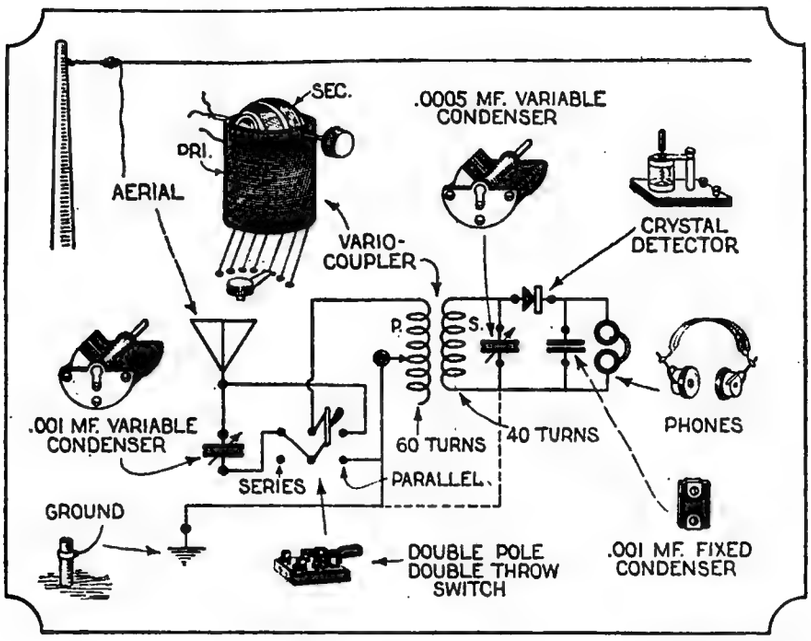
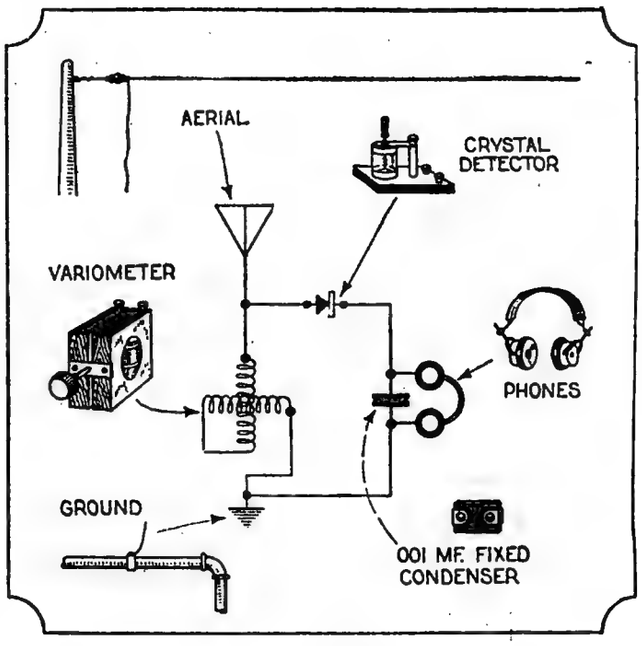
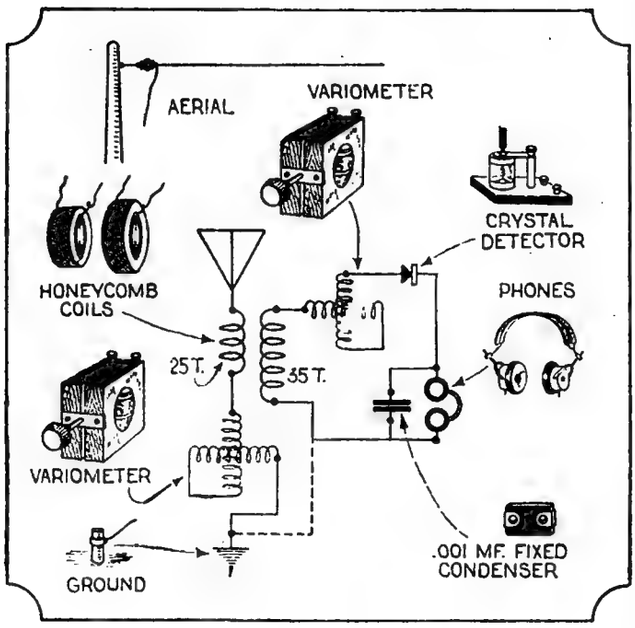
A Page for the Novice

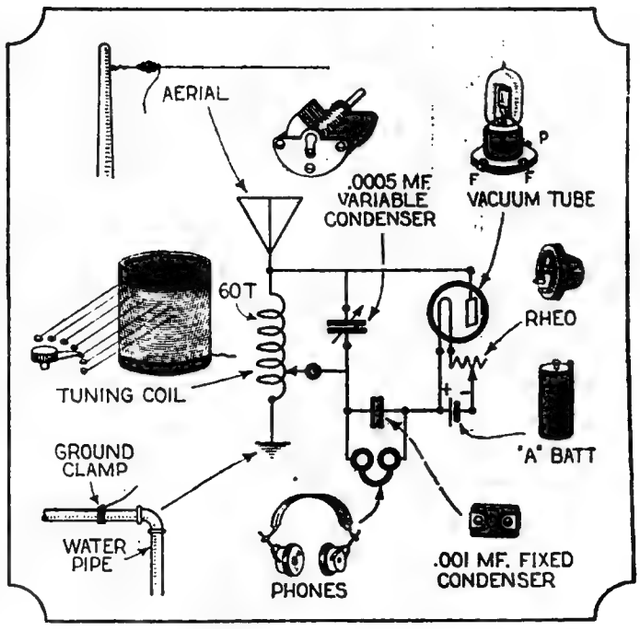
PART II.



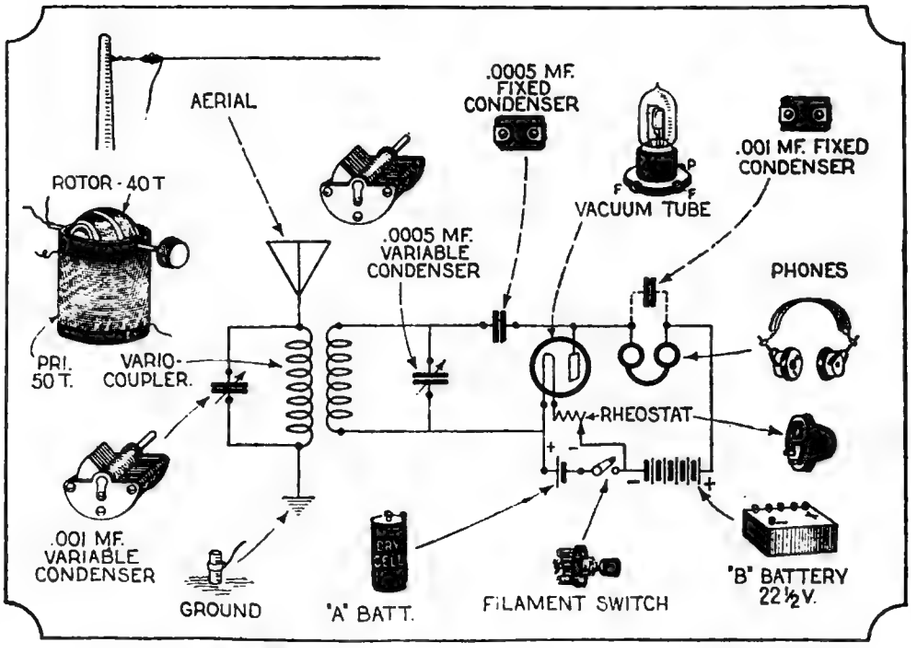




The diagram in the upper left shows the use of a series-parallel switch in a crystal set hook-up. Its function is to place the antenna condenser in series or in shunt with the primary inductance. When in series, shorter wave-lengths can be obtained; when in parallel, longer wave-lengths are received. The variometer-tuned sets in the upper right and diagram to the left are simple sets to construct, which give results. The principle of the variometer is readily understood. When the rotor and stator windings are in the same direction, the inductance is a maximum; when opposing, it is minimum.



The diode or two element tube, since its inception by Fleming, has been used with success in many simple circuits. Its action depends upon the well-known "Edison effect." Edison found that electrons were emitted from a heated filament and were attracted to a cold metal plate positively charged. This at once led to the discovery of the rectifying action of the diode tube. Two circuits are given herewith showing how the tube is used with and without a "B" battery and in both conductively and inductively coupled circuits. A single dry cell is all that is required to operate the filament. Louder signals can be had than with a crystal detector. The tube has what is known as an amplification factor which increases the signal strength.



It is well to keep in mind when purchasing variable condensers that a .001 has 43 plates; a .0005, 23 plates; a .0003, 15 plates; a .00025, 11 plates. Fixed condensers are rated, not according to the number of plates they contain, but to their capacity in microfarads. When buying them, specify whether you want a grid condenser, .00025 to .0005; a phone by-pass, .001 to .006; "B" battery by-pass, .002 to 2 mf., or antenna series, from .00025 to .006. It is best to use heavy wire, well insulated, when wiring a set. A very minimum of soldering paste or resin should be used when making connections. All leads should preferably be short, but the instruments should not be crowded together. Remember not to connect the "B" battery before testing the "A" battery circuit.

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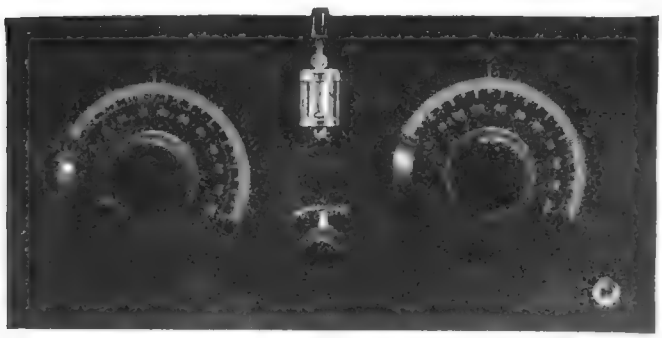
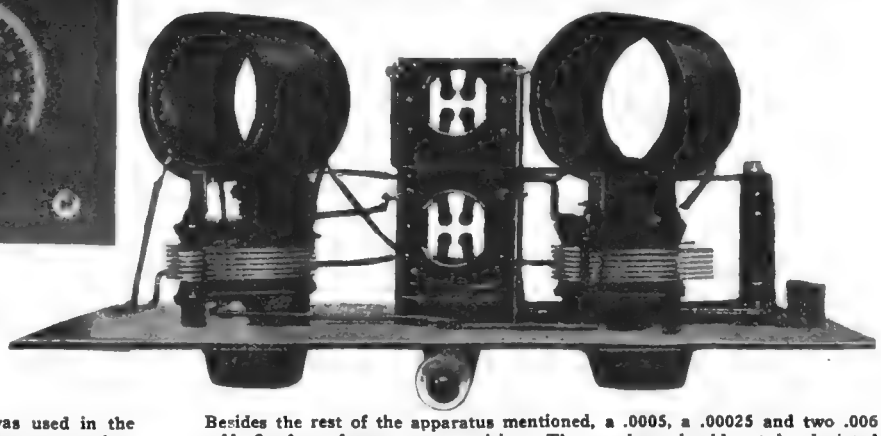
A Two Tube Reflex

A Circuit Which Gives Excellent Results

By ALFRED R. MARCY, A.M., I.R.E.

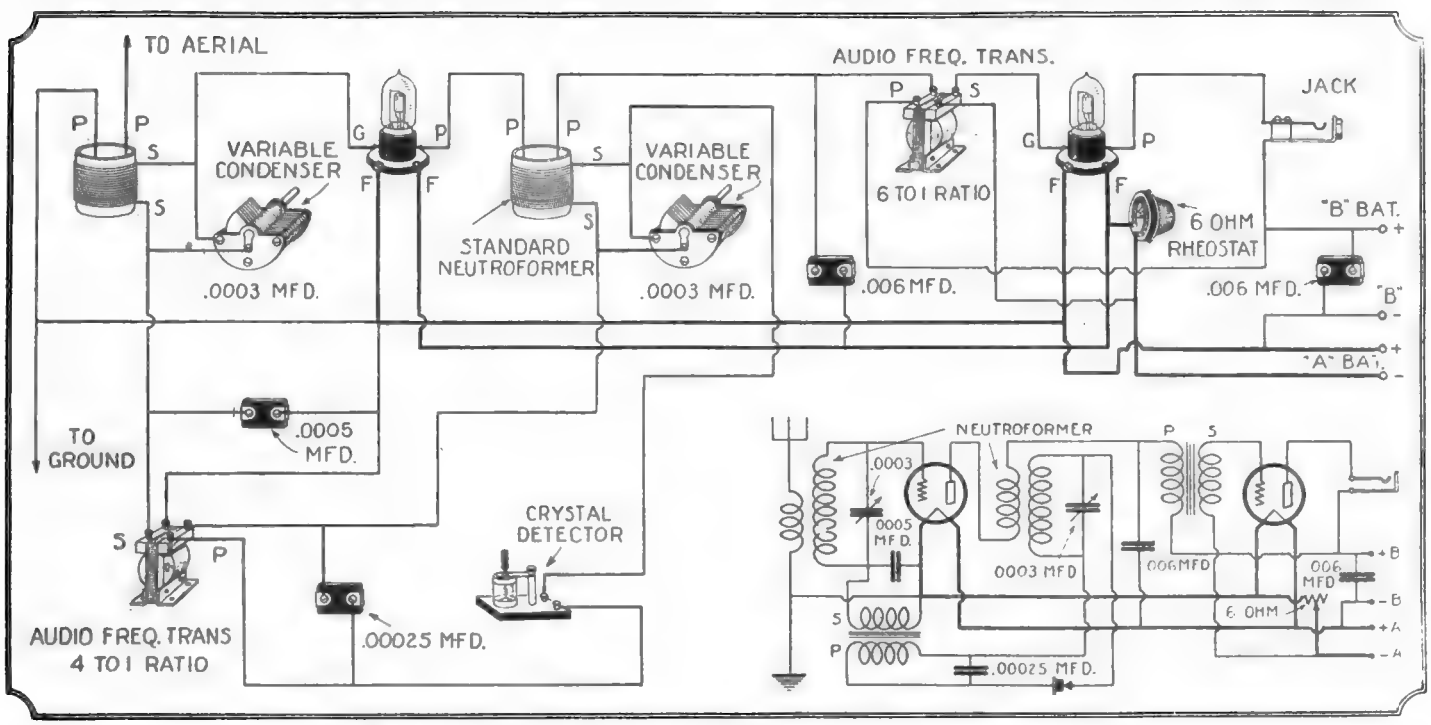


Looking down upon the set showing how the neutroformers are mounted at the proper angle of 54.7°. The neutroformers are composed of a variable condenser of 13 plates and two inductances, one the primary of 15 turns, and the other the secondary of 65 turns of No. 26 D. S. C. wire.



THE reflex circuit is well known for its simplicity of control, clarity of reproduction and volume. Using but two 201A tubes, such stations as KDKA, WDAP, WGY, WBZ, WSAI, WTAM and many of the other large broadcasting stations within a radius of 1000 miles are heard regularly with loud speaker volume. Distant stations such as WDAF, WOAW, KFKX and WFAA come in very nicely on the headphones. To secure such good results necessitated the selection of reliable parts and great care was used in the construction. Mounted on a panel 7 x 14 are two neutroformers, a glass enclosed sensitive crystal detector and a six-ohm rheostat. A single circuit jack is also incorporated as well as four binding posts. Behind the panel are placed two audio frequency transformers and two standard sockets.

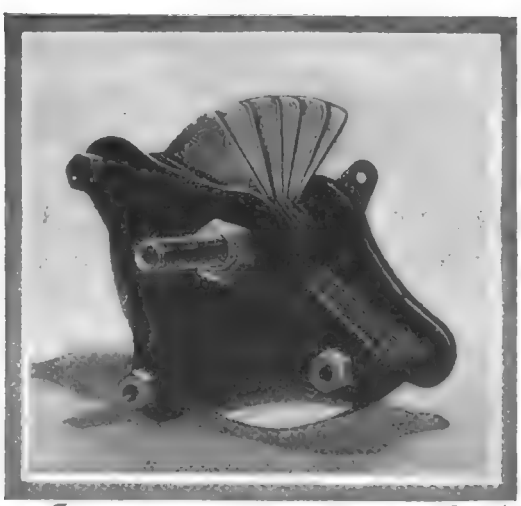
Besides the rest of the apparatus mentioned, a .0005, a .00025 and two .006 mfd. fixed condensers are requisite. These values should not be deviated from since the successful operation of the set is controlled in a great measure by them. It must be remembered, however, that the entire operation of the set depends upon the sensitiveness of the crystal detector.



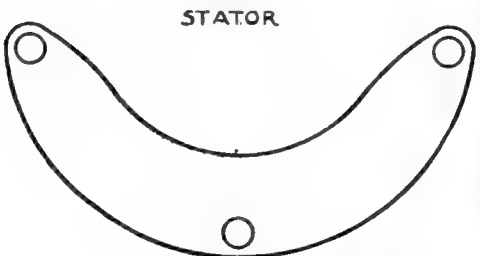
Short Wave Condensers

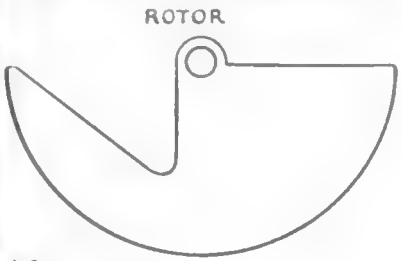
By 2DK

With the incentive of the short waves appealing to both amateur and broadcast stations, it becomes necessary in order to follow them, to meet the conditions, by changing both capacitative and inductive apparatus. It is by far easier to remove some turns on an inductance, but as that capacity is used to change the wave-length, the absolute necessary minute adjustment, is obtainable. This is due to the fact that with short waves a small change in dial reading very greatly affects the wave-length. Hence it is necessary to alter our condensers.



Three simple and effective ways in which to change the maximum capacity value of a condenser are depicted herewith. One is to cut the stator plates as shown at the left. A better way perhaps is that of cutting the rotor plates so that a given change in dial reading corresponds to a very small change in capacity. Those already having a short wave condenser and desiring a vernier action will do well to follow the suggestion shown in the photograph. Here, each successive plate is cut shorter than the one adjacent to it. Burrs should be filed off.





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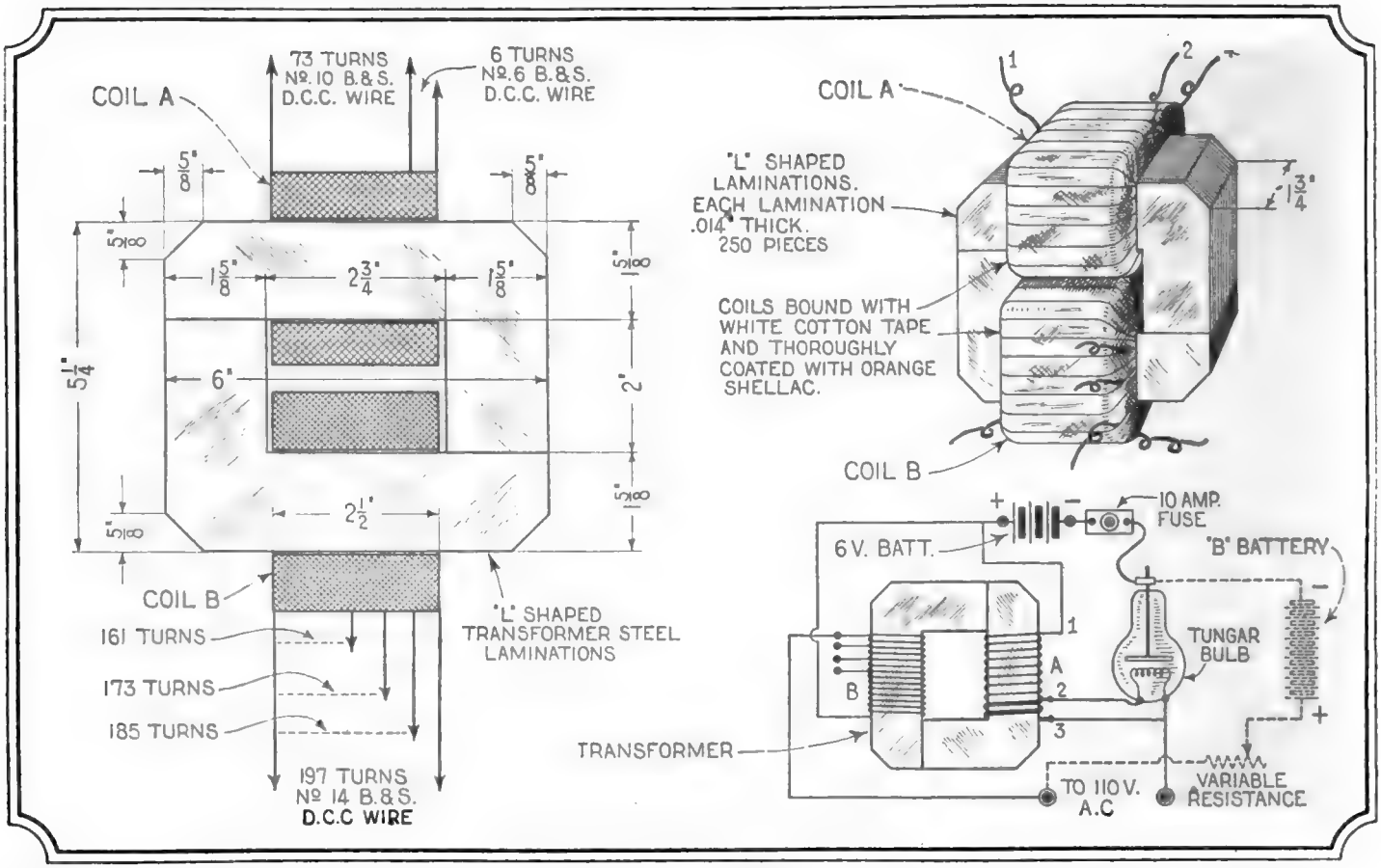
Radio Oracle

In this Department we publish questions and answers which we feel are of interest to the novice and amateur. Letters addressed to this Department cannot be answered free. A charge of 25c. is made for all questions where a personal answer is desired.



A transformer for the purpose of charging both the "A" and "B" batteries is detailed clearly above. It is well worth the trouble to construct. It is designed for operation on 110 volt, 60 cycle alternating current, and if carefully built will last indefinitely.

BATTERY CHARGER

(334) B. Steinmetz, West New York, N. J., asks for:

Q. 1. Constructional details of a transformer to be used in conjunction with a 5-ampere-hour capacity Tungar rectifier tube.

A. 1. The time has come when the recharging of storage batteries, both "A" and "B" types, necessitates a much more convenient way than the carrying them several blocks to the nearest battery station, with, perhaps, the dire results accruing from spilling the acid over one's clothes. The best means of overcoming this difficulty is to charge them at home. A transformer for that purpose has been designed along the lines given in the above diagram and will meet all requirements. It is of the auto-transformer type, having three different windings on it. The core is made of laminated silicon steel, "L" shaped, in two sections, which are butted together and securely fixed after the coils have been put in place.

One hundred and twenty-five laminations are placed in a pile 1¾ inches high and constitute one leg of the core. Two or three layers of tape are wound tightly over it, after the laminations have been squeezed together as tightly as possible. On this are wound 197 turns of No. 14 B. & S. D.C.C. wire, taps being taken off at the 161st, 173rd and 185th turns. The winding must be confined within a space 2½ inches wide. This is shown as coil "B" in the diagram.

After having prepared the second leg of the transformer as outlined above, six turns of No. 6 B. & S. D.C.C. wire are wound on and serve as the filament winding. Directly over this are wound 73 turns of No. 10 B. & S. D.C.C. wire, which furnishes the current for charging the "A" battery. It will be noted that the two coils are connected in series with the winding on leg "B".

Having finished the windings, they are carefully taped and shellacked. The legs are then butted together and securely held together with wooden cleats. The variable resistance shown is a bank of five 40-watt lamps which is used to regulate the charging current. A 10-ampere fuse is connected in series with the battery and prevents overcharging. The transformer should be mounted on a slate or asbestos base.

STANDARD FREQUENCIES

(335) Milton Sills, Staten Island, N. Y., requires information concerning the time of the transmission of standard frequencies from WWV, the station of the Bureau of Standards, located at Washington, D. C.

A. 1. The Bureau of Standards transmits, twice a month, radio signals of definitely announced frequencies, for use by the public in standardizing wavemeters and transmitting and receiving apparatus. The signals are transmitted from the Bureau's station, WWV, at Washington, D. C., and from Station 6XBM, Stanford University, California.

The transmissions are by unmodulated continuous-wave telegraphy. A complete frequency transmission includes a "general call," a "standard frequency signal" and "announcements." The "general call" is given at the beginning of the eight-minute period and continues for about two minutes. This includes a statement of the frequency. The "standard frequency signal" is a series of very long dashes with the call letters (WWV or 6XBM) intervening. This signal continues for about four minutes. The "announcements" are on the same frequency as the "standard frequency signal" just transmitted and contain a statement of the measured frequency An announcement of the next frequency to be transmitted is then given. There is then a four-minute interval while the transmitting set is adjusted for the next frequency.

The signals can be heard and utilized by stations equipped for continuous wave reception at distances within 500 to 1,000 miles from the transmitting stations. Information on how to receive and utilize the signals is given in Bureau of Standards Letter Circular No. 92, which may be obtained on application from the Bureau of Standards.

WANTED!!! RADIO ARTICLES

WE want descriptions of new radio ideas which you have worked out in practice. Take photographs of the important parts and make pencil or pen and ink sketches of the hook-ups or mechanical details, et cetera. We are particularly desirous of obtaining new hook-ups and descriptions of single tube sets, reflex and other types which have proven satisfactory. We like articles on new single tube receptors. We will pay good prices for your ideas. —Editor.

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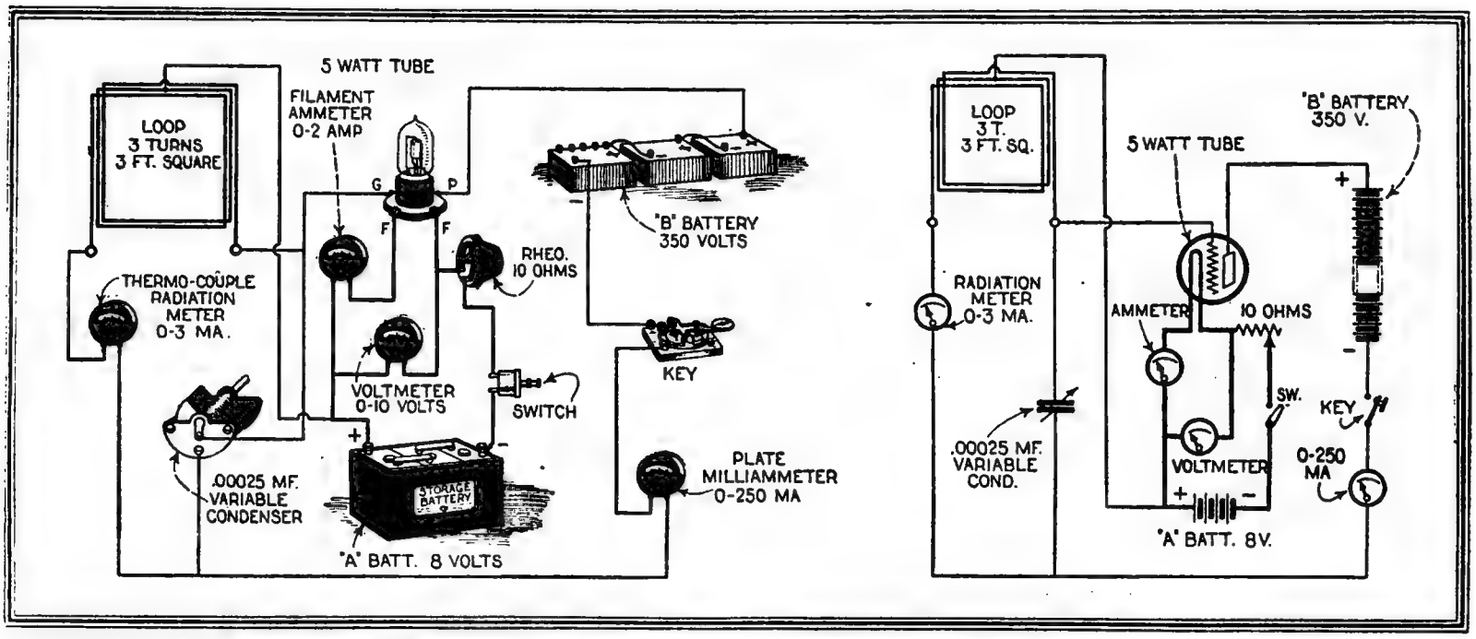

A simple loop "C.W." transmitter. When properly built this set will give excellent service. Its low first cost and up-keep should make it very popular with the beginner. It can readily be equipped for phone transmission.

LOOP TRANSMITTER

(336) Robert T. Morris, New York City, asks:

Q. 1. Will you please publish a diagram using a 5-watt transmitting tube in conjunction with a loop antenna and the other necessary materials to be used in a set capable of covering a range of approximately 25 miles?

A. 1. As a foreword, your attention is called to the fact that unless one has an operator's license from the Government, he cannot lawfully operate a radio transmitting set.

The circuit shown in the diagram has been found to be a very efficient one and under ordinary conditions has easily covered the 25-mile range. This set should be tuned, for best results, to 100 meters or thereabouts. By turning the loop, directional effects can be obtained very nicely. The indicating meters can be dispensed with if so desired, but for maximum efficiency, should be included. The loop is wound with three turns of No. 12 enameled copper wire spaced two inches apart and has a tap at its exact center. The .00025 variable condenser is of the double spaced type so that it can withstand high voltages. Anywhere from 90 to 350 volts of "B" battery can be employed, the higher the voltage the more power radiated. If desired, a grid leak and grid condenser can be connected in the circuit, in which case it is possible to control the tube's oscillations more readily.

For phone transmissions, a 3-to-1 ratio audio frequency transformer is connected with its secondary in series with the grid and loop. A microphone and a 6-volt battery are connected in series with the primary of the transformer, which completes the modulation system. Of course, the transmitting key is closed when transmission of the voice is desired.

Care should be taken to prevent overloading the tube by allowing too much filament current to operate it. A slight increase of filament current is far more dangerous to the longevity of a tube than a rather large increase of plate potential.

BODY CAPACITY

(337) Richard Larson, Kansas City, Mo., wants to know:

Q. 1. What is the body capacity and how can I overcome it? It causes me a great deal of annoyance and I would like to know whether there is anything wrong with my circuit.

A. 1. Body capacity, or hand capacity, is the term applied to the property of the human body which makes it act as a member of an electric condenser. Your body is not a good condenser. Compared to the variable condensers in a receiving set it has an extremely small capacity. The trouble is that even an extremely small variation in either the capacity or inductance of a set can throw fine tuning out of adjustment.

Each time the operator's hand takes hold or lets go of a knob in the process of tuning, the capacity of the set varies by a small amount, because some of the body capacity is communicated to the set while the hand is in contact with it. Then you know too well what happens.

A very fine adjustment of the total capacity of a set can be obtained with modern vernier knobs rotating the parts of the condensers, which supply practically all of the capacity of the circuit. In the same way a very fine adjustment of the total inductance is obtained by rotating the parts of the coils which supply nearly all of the inductance in the circuit. Thus these two elements in the set itself can be very closely controlled.

Some radio enthusiasts who can build anything from a pocket crystal set to a Super-Heterodyne do not know just why this adjustment of capacity and inductance values is so important in its effect on reception. As the voltage supplied to the set by batteries or lighting circuit is constant, minimum resistance means maximum current. With the maximum current flowing through the set, you have reached the point of resonance—the point at which signals are strongest.

Attempts have been made to eliminate body capacity by various methods, but the most effective has been the protection of the panel, or in some cases of individual parts of the set, with a metallic shield. The shield, until recently, had to be applied either by the user or by the dealer, but an "anti-capacity" panel of hard rubber is now being made with a shield vulcanized in place. Shielding, while decreasing the effects of body capacity, does not detract in any way from the quality or volume of the tone.

In order to make shielding thoroughly effective, care must be used in making connections in the circuit. The grid and plate terminals are most sensitive to body capacity effects. Keep the parts of the coil or apparatus to which the grid or plate is connected as far as possible from the panel. The filament circuit must be properly grounded. When variable condensers are mounted on the panel, connect the rotor plates to the ground or filament side. There are variable condensers on the market with end rotor plates, which can therefore be termed self-shielding. With a series condenser in the antenna, the rotor plates should be connected to the antenna; with the condenser in the ground circuit, the rotor plates should be connected to the grounded side. A condenser across the secondary should have the stationary plates connected to the grid.

Body capacity manifests itself more readily when the receiving tubes are overloaded, either by too much filament current or too high plate voltage.

DeForest and Fessenden—Read Their Biographies

In the October issue of *Radio News*, there started a biography of Dr. Lee DeForest, inventor of the Audion. This biography will run for 12 months in *Radio News* and we hope all SCIENCE AND INVENTION readers will read this important work by the famous inventor. Prof. Reginald A. Fessenden's biography started, in the January number.

LIST OF ARTICLES TO APPEAR IN THE MARCH ISSUE OF "RADIO NEWS"

Marconi's Radio Beam Transmitter
By Lt.-Col. Chetwood Crawley, M.I.E.E.

The Navy's World-Wide Radio Net
By G. K. Spencer, U.S.N.R.F.

Is Radio Earthbound?
By D. C. Wilkerson

An Ultra Short Wave Receiver
By the Staff of Radio News

The First Annual Radio Set Directory
By Hugo Gernsback

When Buying Vacuum Tubes
By Vernon C. Mcnabb

Notes on the Super-Heterodyne
By Wilfred Taylor

The Radio Uni-Set
By H. M. Towne, 1ADG

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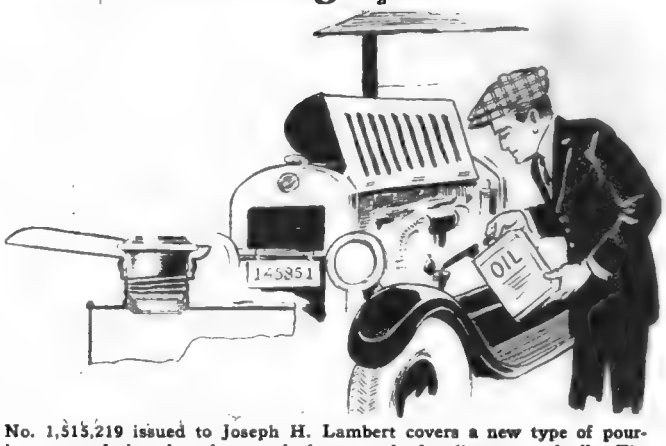
LATEST PATENTS

Blotter Holder

No. 1,514,920 issued to Tsuta Miyaski concerns a little device that should interest every business executive, bookkeeper or clerk who has frequent recourse to the use of a blotter. The device consists of a U shaped member, composed of a strip of spring material. Two clips on either end hold a strip of blotting paper in place for use as shown.

Pouring Spout



No. 1,515,219 issued to Joseph H. Lambert covers a new type of pouring spout designed to be attached to standard gallon cans of oil. The hole in the spout is so designed that the flanged edges fit within the opening on the can. This is designed to be attached when the can is manufactured. The spout provides an easier method of pouring the oil as shown.

Smoking Pipe

No. 1,517,448 issued to Albert Ulysses Montgomery relates to an improvement in the construction of pipes for use with smoking tobacco. As will be seen from the above drawing, smoke issues from the bottom of the inserted bowl, rises and follows the spirally cut groove to the horizontally extending portions of the pipe where it in turn enters the tube and thence goes to the mouth. A very cool smoke results from the long passage.

WANTED

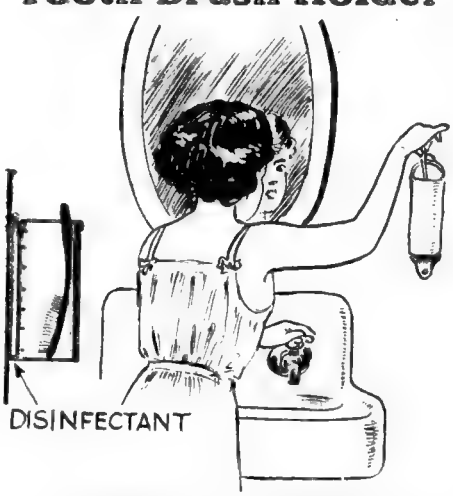
ARTICLES pertaining to automobiles such as handy kinks, roadside repairs and anything of interest to the man who drives a car. $50.00 in prizes every month are offered by MOTOR CAMPER AND TOURIST for such articles. Get a copy at your newsstand and see what is wanted. If your newsdealer cannot supply you send for free sample copy to:

MOTOR CAMPER & TOURIST
53 Park Place,
New York City.

Vanity Case

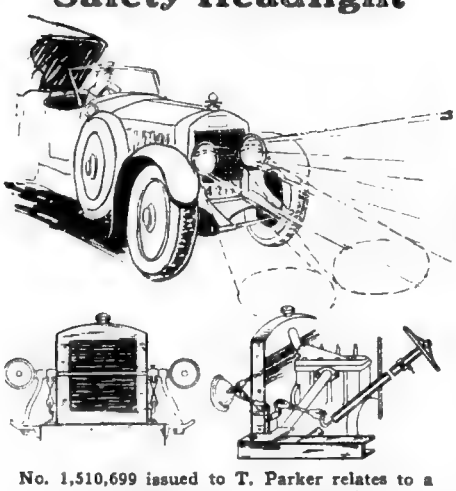
No. 1,518,103 issued to Salvatore Piciotto was granted on a novel type of vanity case which is illustrated above. Essentially, the case is shaped in the same manner as an automatic pistol. Hinged in the center, the sections open and disclose various necessities for the female toilet. Placed where the muzzle of the gun would be is a vial of perfume with a plunger inserted. Pulling the trigger ejects the liquid.

Tooth Brush Holder



No. 1,517,575 issued to Marie Nordstrom and Elliott R. Brown covers a device that should be used in every home. It is a tooth brush holder that at the same time contains an active disinfectant, the fumes of which circulate through the bristles of the brush, effectively preventing the propagation of germs. The disinfectant holder which is situated at the back of the tooth brush container, is removable therefrom so that the disinfectant may be renewed. The brush holder is also equipped with a cover which excludes dust and other foreign matter.

Safety Headlight



No. 1,510,699 issued to T. Parker relates to a new and simplified type of automobile headlight which is capable of being tilted downward so as to avoid throwing a glare of light in the eyes of approaching drivers. The mechanism and effect is shown above.

Fused Socket

No. 1,516,520 issued to Louis Cross pertains to an improvement in multiple electric-light plugs. In the circuit of each of the sockets of the plugs is placed a fuse socket in which fuses are to be placed, said fuses being capable of protecting the main fuses and the wiring of the house. Low amperage fuses are used at the socket and since they are always in sight are very easy to replace.

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Scientific Humor

THEN HE GETS BOILED

Doc: "What precautions do you take against microbes?"

Pat: "First I boil the water—"

Doc: "Yes, and then?"

Pat: "Then I sterilize it—"

Doc: "That's right, and then?"

Pat: "I drink nothing but beer."—*Chas. Grill,* Reporter No. 15,542.

WARDEN, THROW THE SWITCH

Professor: "What is a tissue?"

Honor Student: "A tissue is a collection of similar cells."

Professor: "Illustrate!"

Honor Student: "Sing Sing!" — *Louis Rosenfeld,* Reporter No. 4,358.

—AND FLAPPERS IF THEY SMOKE, COMBUSTION ENGINEERS

If barbers are to be called chirotonsors, then egg dealers should be called embryologists, and street cleaners, sanitary engineers, and fish dealers should be called ichthyologists.—*Louis Rosenfeld,* Reporter No. 4,358.

APPLE SAUCE

Physics Teacher (in an English Grammar School): "And can anyone tell me what thought passed through Sir Isaac Newton's head when the apple fell on it?"

Voice from Class: "Jolly glad it wasn't a brick."—*Jack H. Grant.*

MARS WAS DOUBTBLESSLY OUT WITH VENUS

"Astronomers looking at Mars see green."

"That's nothing. I do the same thing every time I spy my rival with my girl."—*Les Van Every.*

SPECIFIC HEAT

The freezing point may be 32 degrees Fahrenheit, but I met a flapper last summer who froze me up when it was 90 degrees in the shade.—Sol *Kats.*

A WEAK RETORT!

Speakmore: "What is the oldest and most popular weekly in America?"

Sayless: "The bath, of course."—*Peter P. Udre.*

SOMETHING ABOUT THE POLES

Professor: "Why is it so cold near the north and south poles?"

Student: "To keep the earth's bearings cool."—*E. R. Lamarche.*

S O S

These are radio days. An indignant lady said to a gang on her block: "And what did the poor little dog do when you brutal boys tied a can to his tail?"

"Oh, he just went broadcasting down the street," was the reply.—*Merle Holmes.*

HE DIDN'T USE HIS EMERGENCY

Kind Lady: "How did you lose your teeth, sonny?"

Sonny: "Shifting gears on a lollypop."—*John Gray Moxey, Jr.*

First Prize $3.00

REVENGE AT LAST!

Barber (in radio store): "Gimme a filament switch."

Radio Dealer: "How about a "B" battery?"

Barber: "No, just a filament switch today."

Radio Dealer: "We have some very fine dry cell batteries, some new tubes, and oh, yes, some excellent head phones."

Barber: "No! No! Gimme my switch, will ya?"

Radio Dealer: "All right, but remember when I come in to get a shave, don't try to talk me into a haircut, shampoo, massage and all the other trimmings."—*Hymen Bushlowitz.*

THE FLIVVER IS NOT AN AUTO.

Hank: "What are you writing?"

Frank: "I'm writing a biography of Henry Ford."

Hank: "Hadn't you better make that an auto-biography?"—*A. Daansen.*

We receive daily from one to two hundred contributions to this department. Of these only one or two are available. We desire to publish only scientific humor and all contributions should be original if possible. Do not copy jokes from old books or other publications as they have little or no chance here. By scientific humor we mean only such jokes as contain something of a scientific nature. Note our prize winners. Write each joke on a separate sheet and sign your name and address to it. Write only on one side of sheet. We cannot return unaccepted jokes. Please do not enclose return postage.

All jokes published here are paid for at the rate of one dollar each, beside the first prize of three dollars for the best jokes submitted each month. In the event that two people send in the same joke so as to tie for the prize, then the sum of three dollars in cash will be paid to each one.

BUT THE STUDENT'S HEAD WOOD

Prof.: "Suppose you had a tomato can full of dynamite and you should drop it. Would it explode?"

Student: "No, but the dynamite."

Prof.: "Sir, dynamite can't be exploded by dropping, can it?"

Student: "No, but a tomato can."—*C. E. Weinland.*

IT WAS A LECTURE ON SOUND

Hiney: "How ya feeling?"

Vic: "Rotten."

Hiney: "Whassamatter?"

Vic: "Got insomnia."

Hiney: "How come?"

Vic: "Woke up twice in Physics this morning."—*Israel Brightman.*

PUTS A FULL STOP TO THE MAN'S CAREER

This month's cyanide sandwich goes to the prison warden who maintains that the electric chair is a piece of period furniture—because it ends a sentence.—*C. E. Weinland.*

PAGE THE BEES

Customer: "Does this set use honeycomb coils?"

Dealer: "Yes."

Customer: "I suppose that's where it gets its sweet tone."—*Clifton Ask.*

PROFIT IF HE GETS IT

Professor of Economics: "Jones, will you kindly tell us the relation between capital and labor?"

Jones (serenely): "Whenever I lend any of my friends money it represents 'capital,' but when I try to get it back it is a case of 'labor.'"—*E. Keller.*

HE NEEDED A FLOW OF BLOOD TO HIS BRAIN

Teacher (to her physiology class): "What vein controls and balances the flow of blood in the body?"

Johnny (after much thought): "The Juggler vein, ma'am!"—*G. Fasheua,* Reporter No. 16026.

THE ENGLISH PROFESSOR TAKES UP SLANG

1—Cease masticating the fabric.

2—Torrid canines!

3—It is the feline's facial hirsute adornments.

4—Atta young male of the species "homo sapiens."

5—I will announce to the third planetary satellite of the sun.

6—It is the small, succulent fruit.

WHAT DID HIS WIFE SAY THEN?

Physics Prof.: "Can anyone in the class tell me what Benjamin Franklin got when he went out in a thunderstorm and flew his kite"

Smart Student: "Yes. Rheumatism."—*N. Robustos Compton.*

GENIUS, LIKE MURDER, WILL OUT

Rub: "What have you invented this time?"

Dub: "A cigar humidor to fit the inside of a policeman's cap."—*Paul S. Powers.*

IS THIS HIGHER EDUCATION?

Physics Student (to prostrate professor who has stumbled over a stone): "Did you fall?"

Professor: "How utterly imbecilic! Of course not! My body possessing motion produced an impact with a stationary solid substance, which by the law of inertia resisted the force applied to it and destroyed my equilibrium. So not being able to defy or break the law of gravitation, I succumbed to the inevitable and assumed this horizontal position."—*Vladimir Babikoff.*

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Awards in $1000 Monthly Contest

The Regular Departments Pay Prizes of Their Own. Authors on Contract Receive Their Own Rates; this, With Other Special Payments Makes the Total Paid for Articles in Excess of $1500.00 Monthly.

FIRST PRIZE $100.00

Tornado in Movies, by Edwin Schallert.....1074, 1075

SECOND PRIZE $75.00

Navigation Instruments on "Los Angeles," by Dr. Alfred Gradenwitz.. 1083

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Current-Producing Selenium Cells, by W. S. Gripenberg..... 1106
A Two-Tube Reflex, by Alfred R. Marcy..... 1117

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$13,320.00 in Prizes Paid Last Year

WITH the December issue our $12,000 a year prize contest came to a happy conclusion. Not only did we pay out $12,000 in prizes as announced in our November, 1923 issue, but we did actually pay out in prizes alone, not less than $13,320.00 to 1,112 winners. These prizes every month ranged from the first prize of $100.00 down to the smallest prize winner of $1.00 each.

Up to the time of going to press, SCIENCE & INVENTION had no less than 19,000 reporters scattered over every section of the globe. These reporter-contributors have sent in an avalanche of material, and their efforts have been fruitful in that they have won prizes.

SCIENCE & INVENTION aims to print the news first, if it is interesting and to otherwise excel in the reporting of science and invention. Small wonder then that with the enthusiastic co-operation of our thousands of Reporter-Correspondents, SCIENCE & INVENTION today occupies an enviable position in the scientific press.

The $12,000.00 prize arrangement has worked out so satisfactorily during the year just closed that we have decided to extend it for another year and we hope that our correspondents will be as successful in winning prizes for the coming year as they have been during the past one. We wish to thank all of our friends for their co-operation and wish them the best of luck for the coming year.

Note New Prize Schedule.

Here Is How You Can Get in the Contest:

$12,000 or More in Gold

EVERY month SCIENCE AND INVENTION pays $1,000 or more in gold in prizes. Every text article published will receive a prize—(most of the departments have awards of their own which they give every month). Ideas are what the Editors want. The ideas must be told simply, so that your mother or your sister can understand them—in pictures or sketches or both. But the idea must be new and must have something to do with science or invention.

The Editors want pictures and sketches—must have them—but what they want most

82 monthly prizes will be given as follows:

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	SECOND PRIZE	$75.00	
2	PRIZES OF	$50.00	each
3	" "	35.00	"
5	" "	25.00	"
5	" "	20.00	"
10	" "	15.00	"
15	" "	10.00	"
10	" "	5.00	"
15	" "	2.00	"
15	" "	1.00	"

$12,000 or More in Gold

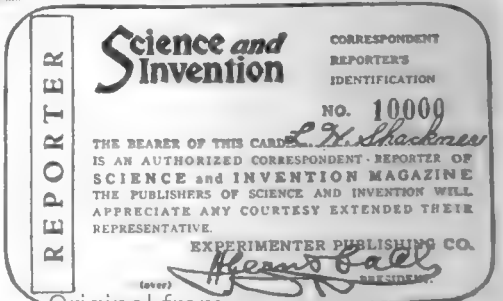
is IDEAS. These ideas will be handsomely paid for. We have published a pamphlet showing the rules of the contest which we shall be glad to send to anyone free on receipt of a postal card with your name and address. The pamphlet gives full details, the rules and how to submit articles. The magazine itself shows you what is wanted. Study it closely and submit your ideas.

The closing date for all prize contributions is the 15th of the month preceding date of issue, *i.e.*, the 15th of March for the May issue, the 15th of April for the June issue, etc.

WILL YOU BE OUR REPORTER?

IN connection with our $12,000 prize contest announced herewith, it goes without saying that you will have to do a little work in order to win a prize. The Editors do not wish to make it hard for you, quite the contrary. We want pictures and ideas and we cannot have too many of them.

Herewith is reproduced our reporter's card. Up to now we have issued over 19,000 of these. Note in our awards how our reporters are winning prizes right along. We shall be glad to send the reporter's card free to anyone who makes an application for it. By means of this card you will be able to secure entry into industrial plants, business houses, motion picture studios, steamships, docks, public buildings, etc. This reporter's card will prove an open sesame to you in many instances. Every card is numbered and only one is given to a correspondent. A postal card from you and a request for this reporter's card is all that is necessary to obtain one. It will be sent to you by return mail. With it we will send you a pamphlet giving rules of the contest and how to proceed in order to get photographs, to send in sketches, and other information in order to obtain a valuable prize. Not only will this card help you to obtain material for this magazine, but it will train you to become a news gatherer, and will be the means of helping you to earn a good deal of money during your spare hours.



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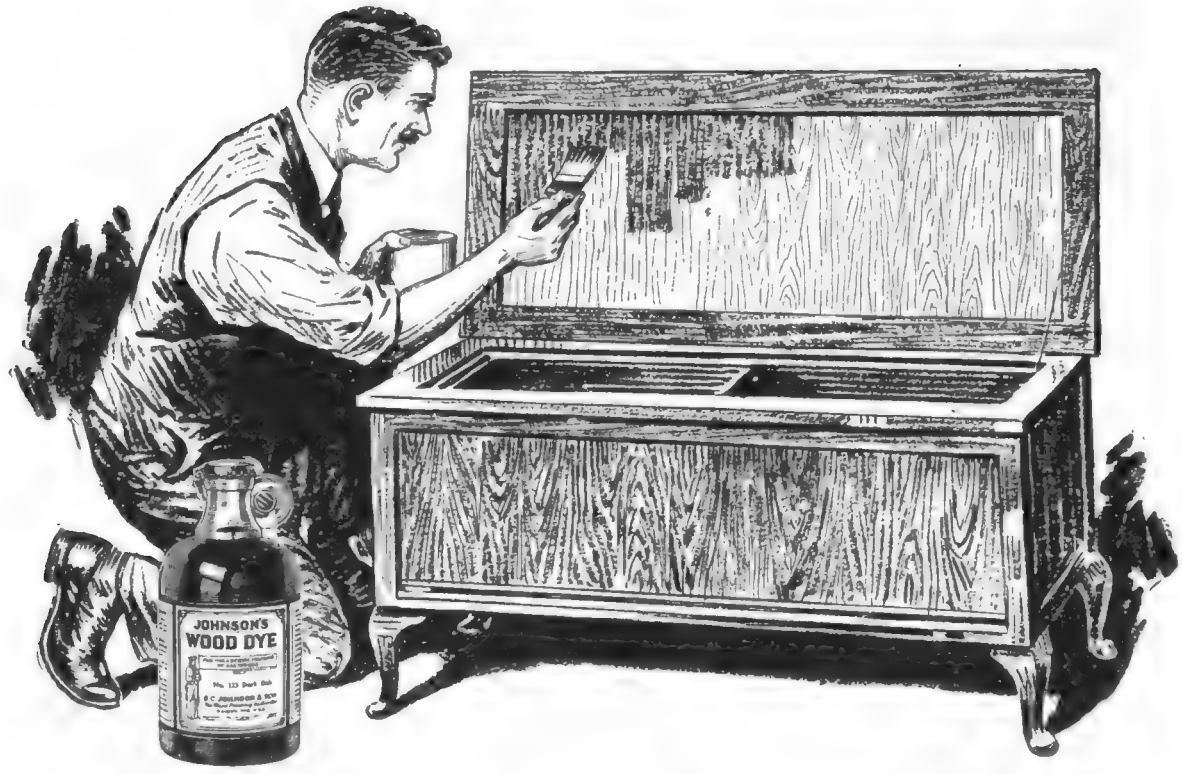

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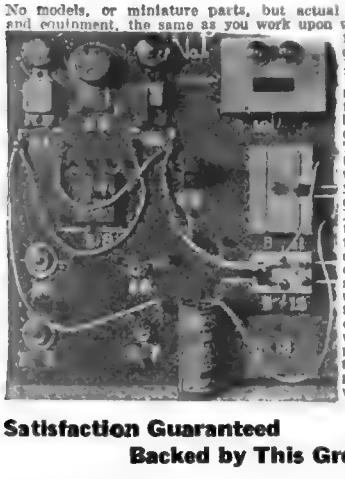

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The Living Death

By JOHN MARTIN LEAHY

(*Continued from page* 1091)

On the 12th of December we passed Cape Horn. The weather was beautiful, the wind from the west-northwest, and the *Multnomah* sailed in close to this weather-beaten and dreaded promontory.

Frontenac had got the cinematograph-camera ready, and some truly wonderful views were obtained of this gloomy and terrible place—gloomy even with the sunshine flooding sea and land.

Banks of cumuli gathering in the southwest told us that our beautiful weather was not going to last long.

The *Multnomah* bore away to the eastward. A number of icebergs were in sight, enhancing the somber aspect of the desolate scene.

And, sure enough, morning found a gale from the southwest howling through our rigging, a tremendous sea running and the air so thick with rain, mist and sleet that often our horizon was within the radius of a hundred yards. Bergs were known to be about us in various directions, and this knowledge, what with our circumscribed horizon, was one by no means conducive to rosy thoughts and speculations.

The wind hauled round to the west and finally to the northwest; by midnight the gale had blown itself out.

When the sun came up, which he did about three o'clock, the *Multnomah* was standing on her course, with everything set save her topsails.

Squalls were of frequent occurrence during the day. Many birds were about the ship—albatrosses, cape pigeons, Antarctic and snowy petrels. Several bergs were seen, and in the afternoon two big rorquals passed within a quarter of a mile of us. The rorqual, by the way, is said to be the largest mammal that has ever existed. The sight of these enormous creatures was a stirring one. It threw Professor Archimedes Bukink into a scientific ecstasy. Out came notebook and pencil, and Bukink proceeded to slap down his observations in whirlwind fashion. He got so excited, however, that he made notes that neither himself nor any one else could make head or tail of. They were about as decipherable as so many Maya hieroglyphics.

"Oh, well," said the professor, "I must fall back upon my visual impressions and imbibe comfort from the certitude that my cacography will be caligraphy on the next occasion when I am favored with the opportunity of making observations upon *Balaenoptera Sibbaldi.*"

Some days passed and brought us near that meridian on which Captain Livingstone planned to enter the pack.

ISLANDS OF ICE

It was seldom that we did not have at least one berg in sight, and sometimes there were dozens. Some bergs were of great size, were, in fact, ice-islands. One measured three miles and a half in length, its height three hundred and eighty feet. It was greatly worn, sculptured into obelisks, pinnacles, towers and great castles, the fantastic forms giving the mass the appearance of a *ghost* city adrift upon the waters.

Captain Livingstone had seen bergs more than five hundred feet in height. Reports of masses much higher than this, however, are on record.

"One of our most celebrated and talented naval surveyers," says Findlay, "informed me that he had seen icebergs in southern regions 800 feet high. The *General von Geen,* August 6th, 1840, passed an iceberg 1,000 feet high."

And this in latitude 37° 32′ S.

It was on the afternoon of the 22nd of December (corresponding, of course, to the 21st of June in northern latitudes) and in latitude 60° 15′ S. that we entered the ice.

A fine breeze was blowing from the northwest at the time, and the *Multnomah* thrust the brash aside as though it were so much thistledown. But this was too good to last long. An hour, and we were in the pack itself. The engine was going now, the ship pushing her way through toward a lead running to the southeastward. It was a tussle, but we got there, and the *Multnomah* went gliding down that lane like a sea bird.

There was hardly any swell here; an eerie silence had fallen, broken only by the soft rustle of the ice. There was an indescribable, ghostly something in that sound.

After about an hour's run, the lead closed. The *Multnomah,* however, drove straight ahead into the ice. Twice she was brought to a complete standstill; but each time her powerful engine drove her on, the third time clean through into open water again.

The sun disappeared about nine o'clock, down in the southwest. A dead calm had fallen. It was a strange, weird scene, and one beautiful beyond description in the wonderful colors of sunset.

Ten o'clock found us hemmed in by great floes—the *Multnomah* at last indeed at a standstill. There was nothing to do but wait for an opening. One might occur in an hour, in five minutes, in twenty-four hours, or a week. For these movements of the ice are as uncertain and unaccountable as the proverbial operations of the feminine mind. The phenomenon, it seems to me, must, in a large measure, be due to the action of wind or current, or more frequently of both. Undoubtedly, too, the tides play an important part. In this instance, the wind could have had nothing whatever to do with it: the ice opened up about one o'clock, and at that time there wasn't a breath of wind, nor had there been for hours.

Rainier was officer of the watch, and he at once sent the *Multnomah* into the opening—conning the ship from the crow's-nest. Though so near the noon of night, it really was not night; rather, it was ghostly day. The sun was less than ten degrees below the horizon, the sky clear, and so a strong twilight flooded the pack.

Yes, that was what it was—not night, but a day, meet for the wanderings of disembodied souls. And yet here were we making our way through this ghostly scene, to wrest from the Unknown some of those grim secrets over which she had held vigil from age unto age—secrets strange and wondrous; weird, horrible things.

When I came on deck at four o'clock, the end of the middle and the beginning of the morning watch, the *Multnomah* was ploughing her way through mushy drift. Floes were all about, however; a number of bergs in sight, two of these monstrous things; while the strong blink to the southward showed us that we should, in all likelihood, ere long have a dense pack to contend with.

The sun was, of course, risen—a blood-red ball of fire low to the horizon down in the southeast-by-east. A wind was springing up from the southwest, and the sky had a chill and angry look.

At seven o'clock, Captain Livingstone took a sight, the sun then being on the

(*Continued on page* 1128)

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The Living Death

(*Continued from page* 1126)

prime vertical or exactly east of us, his altitude twenty-seven or twenty-eight degrees.

The prospect by this time was not a rosy one. The *Multnomah* was threading her way through a sinuous lead. A mile or two, though, and we would be at the end, the way then barred by floes jammed together. Open water was visible to the south but could we get through?

Well, the ship did get through, after much ramming and jamming.

And scarcely had she glided out into the open water when a great mass broke the surface within a hundred feet of our starboard bow.

"There she blows!"

It was a rorqual. A short distance off, another object appeared, an object from which projected a long fin-like dagger.

"Killer!" said Captain Livingstone.

"And there's another!" said Frontenac, pointing.

"And another," I said.

"By Heaven," the captain exclaimed, "they're after him!"

A BATTLE BETWEEN TWO GIANTS OF THE SEA

Of these vicious creatures I had both heard and read some strange and terrible things. Here is one from the great Cuvier himself: we are told that the killer "is a cruel enemy to the whale, which it attacks in troops, tormenting it till it opens its mouth, when they devour the tongue."

What a heartless, soulless, horrible thing Nature is, after all!

The rorqual had taken the alarm, but it was too late. There was a rush, a great disturbance by his head, and a killer had got him by the lower jaw. The whale lashed himself about, turning the sea into a caldron of blood-streaked foam. He threw his head twenty feet into the air, but the killer kept his hold like a bulldog.

Came another rush, another and another; the killers were on him now! Of what followed I can give no adequate description. Fierce as had been the struggle of the whale, it was as nothing to that which followed. It was a horrible and yet a wonderful thing to see. And matters suddenly assumed a rather unpleasant aspect: the combatants were drawing in toward the *Multnomah*, and we could not swing away from them, because already, on the port side, we had the ice close aboard.

The rorqual was a giant even for a rorqual; our estimates placed his length at over one hundred feet. And it was an amazing and awful sight to see the huge creature throw himself—the three killers clinging to his jaws—clean out of the water. But he could not shake them off, and, as he fell, two more of his enemies threw themselves upon him and gripped and slashed with their terrible teeth.

The *Balaenopter* was doomed. Already his struggles were growing weaker; the sea for yards was red with his blood.

At length he lay rolling sluggishly, like a monstrous log.

Came a sudden outburst. The huge beast threw himself half out of the water. Foam and bloody spray showered upon our deck. Then came a shock—a shock under which the *Multnomah* shivered from stem to stern and heeled over until the water came bubbling in through the port scuppers.

It was a breathless, appalling moment; but the most vivid memory of that wild scene is not the terrible things that flashed into my mind or the great laboring body of the whale alongside, but of Professor Archimedes Bukink in pursuit of his notebook!

I honestly believe that he was not in the least alarmed, that he was so engrossed in the scientific aspect of the business (whatever that was) as to be utterly unconscious of the dire possibilities it presented.

For my part, I expected to see whale and killers land on top of us or that monstrous tail sweep the deck.

Back came the *Multnomah* on her roll to starboard. And up rose the great back of the whale. I thought that the monster was going to come crashing through the bulwarks and onto the deck. But, at the very instant that this horror seemed inevitable, a frightful convulsion flung the body away from us. A few moments, and the *Multnomah*, to my profound relief, had got clear. And it was well that she had. For the whale flung himself back again. Up into the air he rose, his mouth wide open, foam and blood flying in all directions. Down he came smashing against the floe, shattering and cracking the ice as though it were glass, crushing one of his enemies against the sharp edge and killing him almost instantly.

"Hooray, old fellow!" shouted Frontenac. "Do it again!"

But that was the last great effort that the *Balaenopter* made to free himself from those clinging horrors. It was patent that his strength was ebbing swiftly now. Already the tragedy had entered upon its final phase.

The *Multnomah* was standing steadily on through the lead, much to the surprise and chagrin of Archimedes Bukink, who wanted the ship to return to the scene of the combat—or at least stand by so he could witness the end.

"What for?" the captain roared.

"For science," quoth the professor, nothing daunted by the vehemence that the other had displayed.

Whereupon Captain Livingstone said that science could go to the pericœci of Paradise.

And that (so we thought) was the last of the killers.

One of them, by the way—the second to appear—had his great dorsal fin cut off to a mere stump. We could tell that fellow if we saw him again. At the time, though, I never thought of that.

I hasten now to the awful end.

CHAPTER XIX

SUB-FIN

There were times when the *Multnomah* made but very little headway during the whole of the twenty-four hours. Indeed, once we did not gain a single foot; we lost. We encountered heavy hummocked pack that day; there was nothing to do but wait for the ice to open; and, while we waited, the current carried us back for some miles.

At other times, though, we made sixty or seventy miles of southing during the twenty-four hours; and once—that was on the 2nd of January, and we were in open pack—the ship made a run of a little over one hundred miles.

On the 8th of January, about nine o'clock in the morning, the *Multnomah* crossed the Antarctic circle. We made a fairly good run that day and had the sun at midnight.

Each day now found the sun at the noon of night a little higher above the horizon and a little lower in the northern sky at midday. Had we been at the Pole itself, we should, of course, have had the sun—save

(*Continued on page* 1130)

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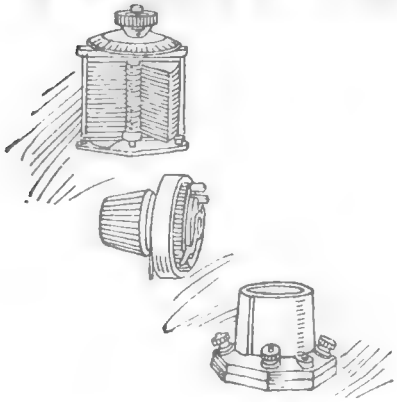

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NOTE:—Before mailing your letter to this department, see to it that your name and address are upon the letter and envelope as well. Many letters are returned to us because either the name of the inquirer or his address is incorrectly given.

RADIATOR DECORATION

(874) James V. Steinman, Wint, Okla., submits a sketch of a device which sketch is reproduced herewith, which is to be attached to the radiator cap of an automobile. As the car proceeds, the breeze created causes the propeller to revolve and through a crank, causes comical movements of the figures. He asks our opinion on a device of this nature.

A moving figure such as illustrated above would, when used as a radiator cap decoration, distract the attention of the driver.

A. Devices of this nature have been proposed before; they are usually merely passing novelties and do not enjoy a wide sale. In order to sell at all, they have to be very cheaply made and, therefore, their construction will be very flimsy. They will not last long and will soon be discarded. The writer drives a good deal and is sure that he would not want a flapping device such as the one suggested by you in front of him all the time. We would not suggest that you invest any money in this device either toward patenting it or commercializing it.

PERPETUAL MOTION

(875) V. W. Puryear, Rochester, New York, asks what prize this magazine is offering for a perpetual motion machine, and whether or not we will publish a description of the machine in this magazine.

A. 1. This magazine is offering a prize of $ 5,000.00 for a working model of a perpetual motion machine. The device must measure up to all of the specifications of a perpetual motion machine and a complete working model must be submitted to these offices. SCIENCE AND INVENTION Magazine reserves the right to publish the results of any or all investigations along this line. You need not worry that such publication will hurt your chances of developing your machine, for the results will be entirely the opposite. Publication of the details of a device in a magazine protects that device for a period of two years and serves to establish priority in case the inventor desires to apply for a patent.

ROADSIDE SIGN

(876) Walter M. Price, Easton, Pa., submits a design of a proposed improvement on roadside sign post, which is supposed to make the reading of the sign easier. The general idea of the proposed sign is illustrated herewith. He asks our opinion on this subject.

A. 1. We do not think much of your idea for roadside sign posts. The main objection is that the total ad would only be visible from one particular point of the road. Also it would only be visible to those passing in one direction, as those going the other way would not be able to see the sign until they had passed. Ordinary flat roadside signs which are worded properly and painted with contrasting colors are not hard to read, and when they are placed properly can be read by passengers in vehicles going in either direction.

We would not suggest that you apply for a patent on your sign because of the facts outlined above.

(*Continued on page* 1134)

A roadside sign such as illustrated above would be visible from one point only.

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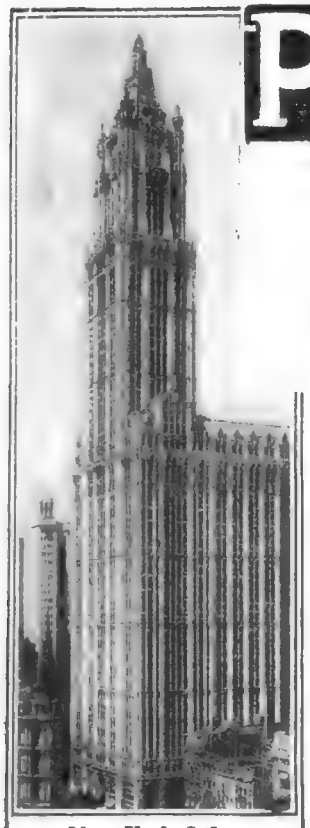

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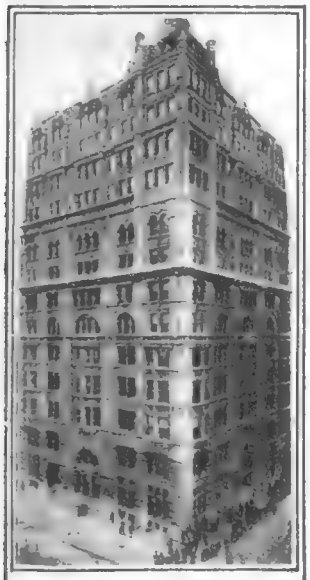

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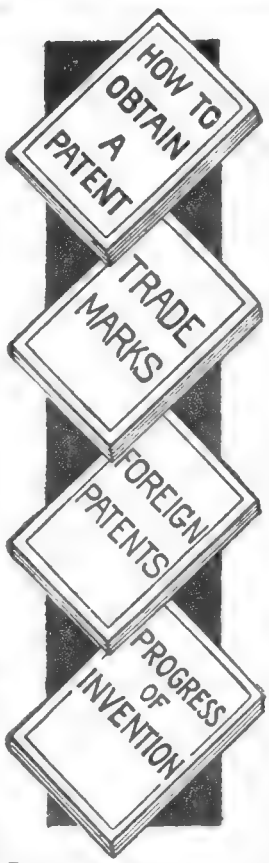

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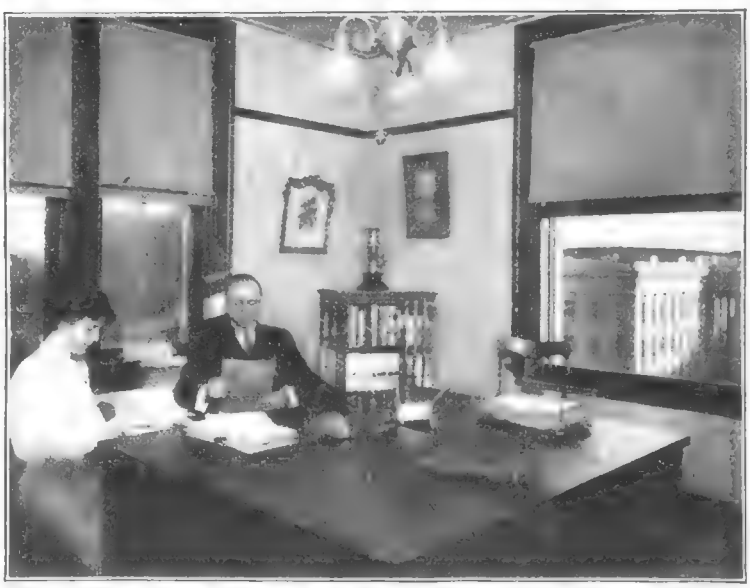

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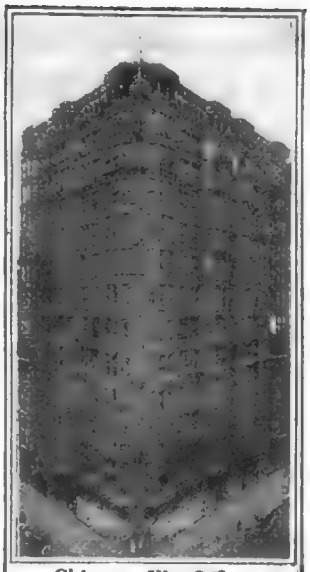

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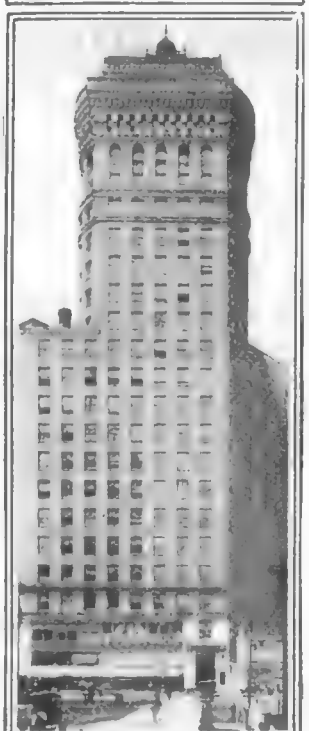

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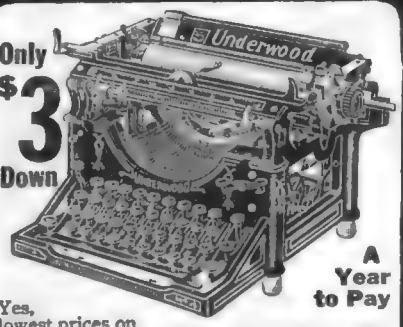

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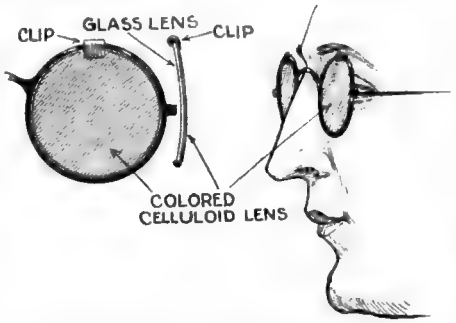
EYEGLASS LENSES

(877) M. D. Nasby, Cedar Falls, Iowa, suggests that a set of colored lenses to be slipped over the regular lenses in eyeglasses, made as illustrated herewith. He wants to know if such device could be patented.

A. 1. There is nothing new in your system of colored lens attachments for eyeglasses. We doubt very much that you could patent an idea of this nature.



Colored lenses to be clipped over eye glasses as illustrated above are not new and do not constitute patentable material.

TOOTH BRUSH

(878) Homer Randolph, Ravenscroft, Tenn., has designed a tooth brush that is to be manipulated by hand and which produces a rotary motion of the brush unit, thereby enabling the user to brush his teeth with both an up and down and a side motion. He asks whether or not we believe the device to be worthy of a patent.

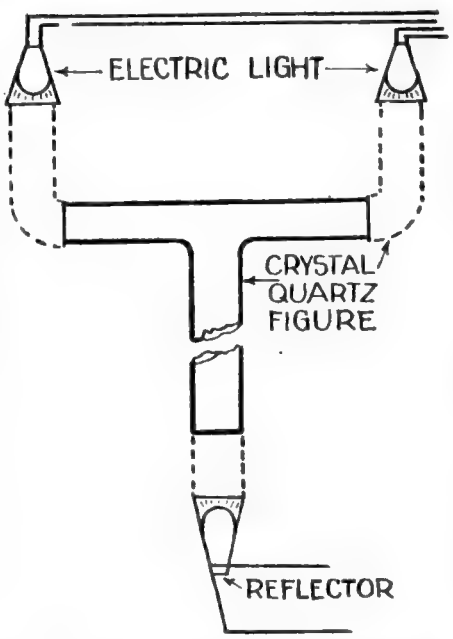
A. 1. The tooth brush you have designed is not new. As a matter of fact several patents have been taken out on a tooth brush of a similar nature in fact, so similar that we doubt you could secure a patent on your idea.

There is great difficulty in placing a system of this nature on the market, and it certainly would not be an advisable procedure unless you are in a position to market the same yourself. Causing a tooth brush of this nature to whirl around while held upon the tooth will likewise produce a movement of the brush, inasmuch as it cannot be held steadily and is liable to greatly irritate the gums of the user of the device.

QUARTZ SIGN

(879) Richard Freeman, Great Falls, Mont., has designed an electric sign which is to make use of a peculiar property of quartz, whereby the quartz can conduct light around corners. The idea is illustrated in these columns and Mr. Freeman desires our advice on the same.

A. 1. The light delivered from a sign of the type you mention will be rather poor, indeed. We would not advise you to patent the idea for this and one other reason. That is, that quartz is very expensive and the saving in electricity will be so small that it will not be compensated for by the use of the quartz.



Quartz glass letters such as shown above would be very expensive.

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The Living Death

(*Continued from page* 1130)

He gave a loud cry. That seated figure slowly turned its head.

"Look out!" yelled Frontenac, starting forward. "Killers!"

I followed.

Captain Livingstone came to his feet. The movement, however, was a slow one; it was clear that he had not caught the dire import of Frontenac's warning.

"Killers!" Darwin yelled. "They're after you!"

THE END OF CAPTAIN LIVINGSTONE

The captain started from the spot instanter, heading in our direction. He had taken but three or four steps, however, when the first killer struck.

The ice cracked and heaved, and the man went down flat. In a moment he was up again, but at that very moment the second killer came crashing up, breaking clean through.

The captain disappeared. In a moment, though, as the ice settled, we saw him once more. For the third time he arose. Then it was that the third killer struck.

We were now close, and—how I shudder to think of it, let alone to write it down—we saw that hideous stub fin appear, then we saw the great jaws close on Stanley Livingstone's body.

That scream the man gave—oh, if I could only forget that sound! The killer reared his head high in the air, holding his victim in his mouth as a cat holds a mouse; then he began to sink from sight.

With a cry of horror, Frontenac threw the rifle to his shoulder. The next instant, the sharp report rang out. If the bullet struck the killer, it did so innocuously. It is my belief that it went wild.

The next instant, a second head came up and seized upon the man.

Then the killers were gone with their victim.

Remained only the smashed ice and those horrid stains of scarlet.

CHAPTER XX

SUMMER HAVEN AND A NEW CAPTAIN

It was on the 20th of January that we sighted land. We were running through open pack that day and through a thin fog (lifting now and then) that rendered our surroundings dim and ghostly. But, along in the afternoon—it was about four o'clock—the fog suddenly vanished, when was heard the welcome and thrilling cry:

"Land ho!"

Captain Ben Rainier, from his dead reckoning, had placed the ship's noon position at forty miles from land. Since then, keeping a sharp lookout, we had made twenty-four miles of southing, and there lay the land right where it was supposed to be, distant some fifteen miles.

I say land, but not a spot of land itself was to be seen anywhere. There, however, was the snow that covered it, rising in high rounded masses, and in the background two mighty, majestic peaks towered up, indistinct of outline, lovely as some Turnerian vision and yet grim as terrible sentinels, too.

"Mounts Theodore Roosevelt and Woodrow Wilson," said Captain Ben Rainier.

By seven o'clock we were off the entrance to Multnomah Pass, but here we were held up by pack ice, and it was not until eight in the morning that we got through.

A few minutes then, and we were standing into the entrance. Dark volcanic rock was now visible in places. Then came the first turn and that remarkable mass of rock which Captain Livingstone had named Multnomah Castle.

"Seems like coming home again!" said Ben Rainier. "Poor Captain Livingstone,

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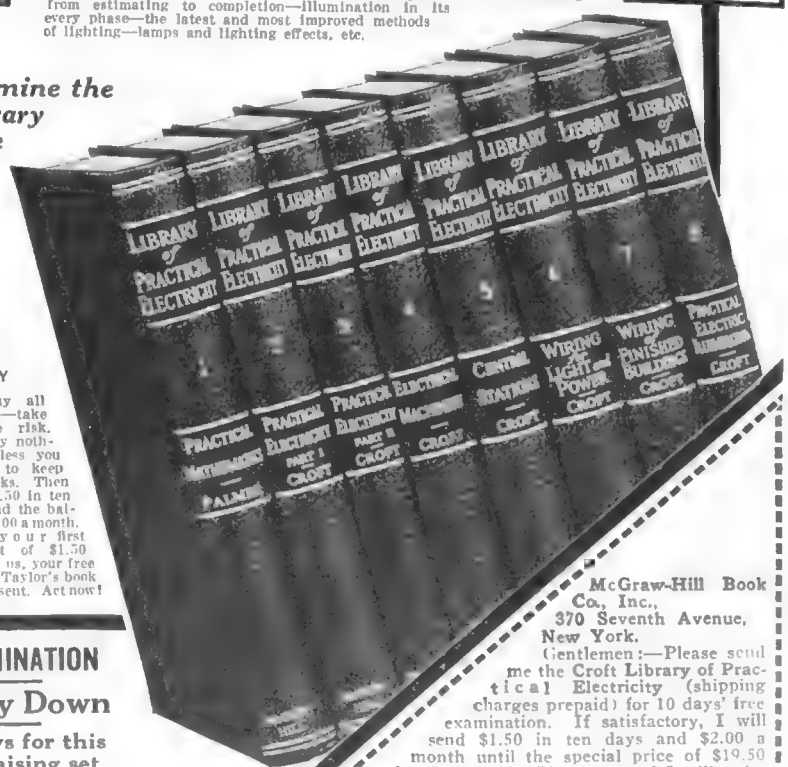
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how he wanted to see this place again before he died!"

Came the second turn, the third, and a few minutes later the *Multnomah* was gliding out into the placid waters of Summer Haven.

And there of a sudden rose the column of boiling water from Hero's Fountain, the steam from it ascending to a height of a half mile or more.

At length I went forward and stood beside Nunatak, who was gazing upon the strange scene with a curious, wistful eagerness and in utter silence.

"Well," I queried, "what do you think of it?"

"Think of it! I was just tellin' myself what a queer place this old world of ours really is."

He waved a hand to the southward and said in a lowered voice:

"And *this* is nothin' to what is down *there* somewheres!"

"Nothing."

"'Tis my idee," Nunatak added, "that of all livin' men none but yourself and Frontenac there knows what Cap Livingstone found in that place."

"None," I told him.

"And a fine pickle this we are in now!" he ejaculated.

"How so?"

"How so? Why, here we are with this long mush before us, and the Lord only knows what at the end of it, and all our dogs dead in that cursed freezer—dead as so many dried herrin's."

I laughed.

"You wait and see."

"I don't have to wait. I've already seen, ain't I? You tell me this, McQuestion: did you ever see Frontenac bring a dog in that fix back to life again?"

"I never have. But I saw him resuscitate a fish—a fish incased in solid ice."

"A fish! If 'twas some humans, now, that I could name, I could entertain some hopes in the matter; but a dog ain't a fish. No, McQuestion, they're dead, them dogs is; they're dead as sardines. The boss is a fine gink, and all that, and a regular *hyas tyee* when it comes to brains; but I'll never be able to forgive him for what he done to them poor dogs."

"So you believe that, if we are to get south, we'll have to tug the sleds ourselves?"

"That's just what we will have to do, unless——"

"Unless what?"

Nunatak leaned closer, and his manner became gravely esoteric.

"Shoot!" I told him.

"Unless," he whispered, "we can harness up a team of these here seals."

"It won't be long," I returned, "before you see all those dogs scampering around the landscape as peppy as they ever were at their peppiest."

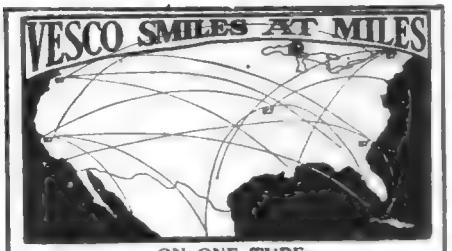
"I'll see a canned oyster playin' a tambourine first! I know. When a dog's *memaloose*, McQuestion, he'll never do any more scamperin' around any landscape nor snowscape—unless, that is, it's in them happy huntin'-grounds.

"But look at them geysers. See them spout—like a school of whales. The Valley of Ten Thousand Smokes is a sight for a man to see; but this Summer Haven, I have to admit, sure has got it beat.

"And now, speakin' of our mush after them same palm-trees, and the good Lord only knows what else, I sure do hope, McQuestion, that this here Cap Rainier don't have charge of the provision-supply."

"Why so?"

"Why so? So's we won't have no dearth of *muckymuck*, that's why. Close! Why, that feller is so parsimonious with supplies that, if he owned the air, he wouldn't let a catbird whistle!"



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The ship stood steadily on, drawing in slowly towards the western shore. At length we opened the *Multnomah's* little cove; not far away was the hut, a strange sight and one melancholy too in this deserted and desolate spot. There was but very little snow on these hills, which rose in long gentle swells like waves. And, towering above all, there in the south, were those mighty peaks—twin Rainiers, each rising fifteen thousand feet into the sky, the beauty of them wonderful, grim and awful.

WE DROP ANCHOR

The *Multnomah* turned into the cove. The engine stopped, an anchor was let go, and the ship swung round to her cable and became stationary.

Here we were at last, and the long, long voyage was ended! But the adventure was not ended. Indeed, this was, after a manner of speaking, only the beginning. What awaited us there in the south? What tales would we have to tell on our return—the terrible Gardens of Paradise explored, Sleeping Beauty, in her block of ice, on one of the sleds? If, indeed, we did not leave our bones down there!

But what was the use of addressing questions to Fate? Did she ever give answers? Never any at all. We must wait. Time only would tell—slow, cruel, inexorable Time. Patience was our only consolation. And in the meantime work—work conducive to strength of body; and thoughts—thoughts conducive to strength of heart and strength of soul.

For surely we should need it all.

CHAPTER XXI

"I WISH THAT HE HAD!"

A boat was at once lowered, and Frontenac, Rainier, Nunatak and myself were rowed ashore and went up to the hut.

"Just as we left her," said Ben Rainier.

"I shouldn't think," Nunatak remarked, "that visitors would be very frequent in these here parts."

"All the same," Rainier answered, "it wouldn't have surprised me at all if we had found somebody here. I thought some fellow would come—well, to see if our descriptions were exaggerated. Nothing, you know, in all Antarctic history, surprised people more than the discovery of this Summer Haven."

"How about the palm-trees?" queried Frontenac.

Captain Ben Rainier had taken a key from a nail above the entrance to the hut; this he had been on the point of inserting in the padlock. But now he turned and looked at Darwin Frontenace earnestly.

"That was different," he said. "We had *proof* of this discovery. Do you, after all, actually believe that Captain Livingstone actually did find palm-trees down there?"

"Why not?"

"Palm-trees within the Antarctic circle. I'm afraid that I can't believe that."

"Here's Summer Haven."

"Summer Haven," returned Ben Rainier, "isn't palm-trees."

"How," Frontenac asked, "do you explain the severed heads of Wilkie, Thompson and Bogardus?"

"I don't believe that their heads were cut off at all. I don't believe that Captain Livingstone knew any more about what became of those men than I know. In short, it is my belief that those severed heads, the palm-trees and all the rest of it, no matter what *the rest* of it was—all that, delirium!" said Ben Rainier.

"We shall see!" said Darwin Frontenac.

Busy were the days that now succeeded, the novelty of our surroundings rendering those days very interesting ones.

Frontenac, Archimedes Bukink, Nunatak and myself moved into the hut forthwith; the others preferred the *Multnomah*.

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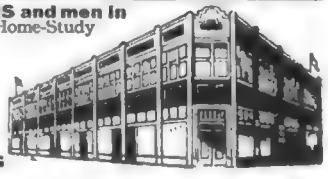

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On the third day a big killer whale—he must have been thirty feet in length—rose near the ship, which apparition elicited from Nunatak some solicitude on the score of Mr. Orca Gladiator's health: the change from the icy waters of the sea to this warmth of Summer Haven might, quoth Nunatak, "give the poor critter pneumony."

THE DOGS BROUGHT TO LIFE

It was on this day, too, that Darwin Frontenac began the resuscitation of the dogs. I was the only witness of the actual restoration itself, which was by no means so simple and easy a matter as the suspending of the vital functions had been.

And never shall I forget that look on Nunatak's face when I brought the first dog up on deck, Skookum by name—the creature as bright-eyed and frisky as though he had just been aroused from a natural snooze.

The musher stared, rubbed his blue eye and stared again, rubbed his black eye and stared harder than ever.

"Can it really be!" he exclaimed. "Is it really you, Skookum—after bein' dead for so long?"

He dropped to his knees, hugged the dog to him and rocked him back and forth, murmuring endearing swear words.

"And I thought that he couldn't do it! Yes, Skookum, old *tillicum* (partner), I thought that Frontenac had murdered you and all the rest, that you was all as dead as so many canned lobsters. But I'll never doubt the boss no more. He can do anything. He's goin' to find them same palm-trees, that everybody thought was so many pipe-dreams, and the good Lord only knows what else besides. I'll head with him for hell itself—and may be that's where we are goin', Skookum—and I'll never ask a single question but just mush along after."

The others were crowding around, gazing at the dog in wonder and perhaps in awe.

I left them and returned to Frontenac.

On being removed from the freezer—five were taken at a time, after the revivification of Skookum—the dogs were placed in another room, the temperature of which stood at thirty-two degrees Fahrenheit. It was slowly increased. At the end of an hour it was fifty degrees. Frontenac now used his antidote. This was a bright purple fluid, its appearance unpleasantly oily, and it was injected into the neck. I tasted this stuff, at Frontenac's suggestion and assurance that it was perfectly innocuous. It had an indescribable, sweetish taste—the strangest imaginable. There was no effect whatever that I was aware of, except a slight tingling on the tongue.

"Weak stuff, after all," I remarked.

Darwin Frontenac smiled a little.

"That's because you are warm."

"Warm?"

"Just so. If your body was cold like these, the effect, I fancy, would be powerful enough—though, of course, you wouldn't be aware of that."

"Then the warmth neutralizes it?"

"I suppose one could put it that way."

"Why, then, did you bring them here? They were colder there in the freezing-room."

"Because the action of the antidote alone will not raise the body to a blood temperature. And, besides, raising the temperature of the body is not its real function, though a very important one, I admit. It's real action—and without that action recovery from a state of suspended animation would be impossible—is upon the blood."

"But," I said, "the blood is not circulating. As far as any vital process is concerned, the animal is as dead as a doornail. How, then, can this antidote be absorbed, permeate the whole circulatory system?"

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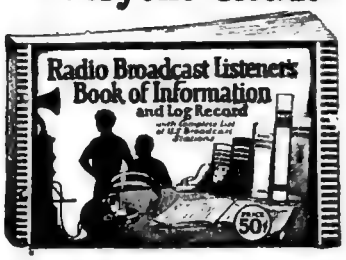

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"I think," Frontenac returned, a smile somewhat esoteric on his lean features, "that a little reflection will give you the answer to that."

For some time after the injection of the antidote—twenty or thirty minutes—there was no perceptible change whatever in the body. But, though not perceptible, a great change was taking place—a change that, at the expiration of the time mentioned, began to make itself manifest. The eyes began to lose that weird, horrible glassiness, the limbs their terrible rigidity. And at length the heart—so long stilled—began to beat and the animal to breathe.

A few minutes, and the animal would yawn and stretch himself, then get up and move around as though nothing untoward had happened to him.

That first day fifteen of the dogs were restored to life, so to speak. The next twenty-five, the day following thirty-two, and the fourth day saw the last body taken from the freezing-room.

Then I would think of Sleeping Beauty, and strange, indeed, were the thoughts that came to me at such moments. Was she really in that strange state that men called one of suspended animation? Was her soul locked up within her body there in her tomb of paleocrystic ice, or was it a corpse that was imbedded there? Poor little kid!

For a time we were exploring around and recovering our land legs, which I was very glad, certainly, to get under me once more.

And for a time our plans were uncertain. Should we lay down depots, then go into winter quarters here at Summer Haven, or should we at once begin our march for the Gardens of Paradise and winter there?

There was much to be said on both sides, and much discussion did we have upon the subject. To pass the winter among the palm-trees—if, that is, we could keep our heads on our shoulders—would, from a scientific point of view, and, indeed, from any other, be an experience replete with extraordinary interest. But, on the other hand, there was our lack of experience to be considered and the uncertainty with regard to the supply of food. To take grub along sufficient to tide us through the winter was out of the question. Could we depend upon providing the necessary food-supply after reaching that wonderful and terrible place? It was Frontenac's belief that we could. Such, too, was my own.

However, the decision which we reached was to get down depots as far to the south as we could, go into winter quarters at Summer Haven and start for the Gardens of Paradise in the spring.

So now came the depot journeys. Three times we left Summer Haven, our faces to the south. On the third journey—"mush" in the vernacular of Louis Louisiana—we got our depot twenty miles or so beyond Captain Livingstone's Depot Number Three.

"Everything so far," said I, "is just as poor Livingstone described it."

"And so," said Darwin Frontenac, "will be everything else. The fate of the discoverer seems to be a hard one—Columbus in chains, Galileo on his knees, our Captain Stanley Livingstone a man greviously, cruelly wronged."

Nunatak turned his face to the southward, and his gaze was a strange and wistful one.

"Palm-trees!" he murmured. "I wisht, now, that I knowed everything that poor Cap Livingstone found down there."

"So do I," Frontenac said, a wan smile passing athwart his lean face. "Bond and I know what he *saw*."

"Well," the musher queried, giving the other a quizzical look, "didn't he *see* what he *found?*"

"Not in every instance," was Frontenac's answer. "I wish that he had!"

(*To be continued*)

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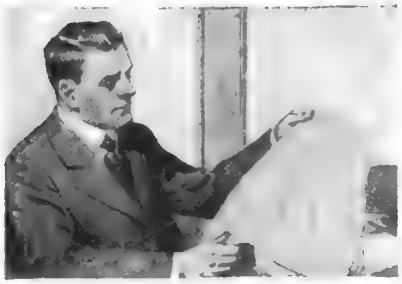

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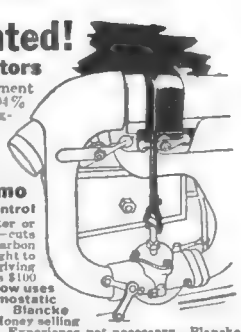

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Doctor Hackensaw's Secrets

By CLEMENT FEZANDIÉ

(*Continued from page* 1095)

fix in which I find myself to-day. You must know that Robert Houdin in his memoirs tells about a trip he made to Algeria on behalf of the French government. There was a plot on foot for an uprising of the natives and the French decided wisely that to send a prestidigitator like Robert Houdin to the affected provinces would impress them far more than the finest army they could organize. The course of events showed the wisdom of their act. Houdin's feats of magic convinced the natives that the whites were powerful magicians and all idea of revolt was nipped in the bud. To see Robert Houdin allow one of their chiefs to load a pistol with a marked bullet, and shoot at him, and then see Houdin catch the marked bullet in his teeth, convinced them that the French were invulnerable.* And when Robert Houdin shot the same bullet at a white wall and drew blood from the wall (a wax bullet filled with blood was used), their astonishment knew no bounds.

"Then, to cap the climax, Houdin asked that the strongest man in the audience should come forth, and offered to take away all his strength and leave him weaker than a woman.

"The challenge was accepted by a husky fellow who had a well-earned reputation for strength. He came forward smiling, and when Robert Houdin asked him if he could lift a fifty-pound iron chest, the fellow scornfully put out his left hand and lifted the box with ease.

"Very well," said Houdin, "now I'm going to take all your strength away from you and leave you weaker than a woman." He made a few passes with his hands before the man's face, and then said, "Now, try to lift that box!"

"The fellow with still greater scorn than before put forth a hand. But the box resisted. Amazed, the man clasped the box with both hands, and bracing himself exerted every particle of strength of which he was capable. His muscles stood out from his body like sinewy cords, and the perspiration dripped in streams from his body, but he was unable to budge the box an inch. Then the poor fellow fell on his knees and begged Houdin to give him back his strength. And, of course, the clever Frenchman did so. A few reverse passes and the man was again able to lift the box with ease."

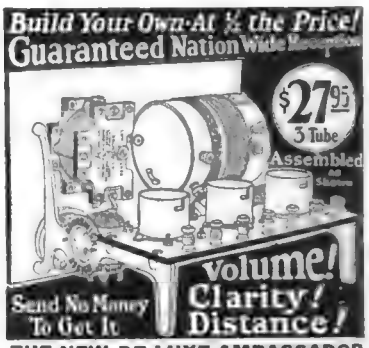
"That was clever," said Pep. "How was the trick managed?"

"Simply enough. The iron casket rested on a powerful electromagnet. When there was no current, the box was easy to lift. When the current was turned on, however, the powerful current caused the box to adhere to the floor so firmly that it was very difficult to move.

"Well, Miss Pep, you may perhaps know that there has been a recent uprising in the African possessions of one of the European powers. I chanced to meet the ambassador of this power, and remembering Robert Houdin's success I thoughtlessly boasted that I could put down the revolt alone, and without any bloodshed.

"He took me up at once, and the result is that you and I, Pep, are now traveling

*Note.—To perform this trick, Robert Houdin used a special ramrod. In the gun was a loose tube into which the powder and marked bullet were rammed. The ramrod fitted tightly into this tube, so when Houdin pulled out the ramrod, the bullet came with it and he was able to place it in his mouth, unperceived.



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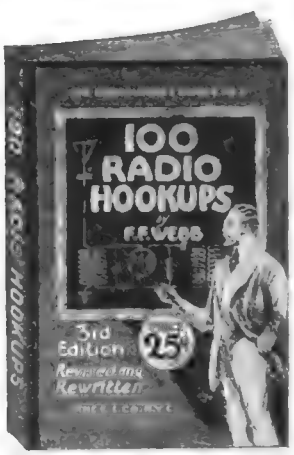

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together to Africa, and that we two are expected to nip in the bud this uprising of thousands of Arabs and negroes."

"Gee!" exclaimed Pep, much impressed. "You didn't tell me I was going to war! You'll have to appoint me general-in-chief. Well, I'm ready now to hear about the radium. I suppose you are going to use that walking skeleton to frighten the natives."

"Precisely. The figure is really solid—not a skeleton at all, but the metal surface is so brightly polished that it is practically invisible except the ribs and other bones which are painted with a composition of my own invention. I could have used phosphorescent paint, but I concluded I could get better results with radium emanation. I suppose you know what radium emanation is?"

"Not exactly."

"If you dissolve some radium chloride in water, the radium will be found to have lost most of its radio-activity and will not regain it for a month—the time required to produce a new stock of emanation. The emanation is really in the water and can be obtained in the form of a gas. It is this gas—this radium emanation and not the radium itself—that produces the principal effects attributed to radium. The life of this emanation is short, however, for in four days it has lost half its activity.

"For my purpose, however, this shortness of life is of no consequence. My skeleton, as you have probably surmised, is an automatic figure which I can control from a distance by radio. Different lentghs of waves will cause different portions of the figure to move. I can make it walk, dance, gesticulate and even talk by means of a phonograph inside. As you probably know, radium emanations to become phosphorescent must be thrown on a screen. Originally it was platino-cyanide of barium that was used for the fluorescent screen, but I use a special powder of my own which I mix with the gas—that is, the radium emanation, and I blow the two together through suitable openings in the body of the skeleton, utilizing the force of the compressed gas for the jet. This enables me to make the skeleton luminous or dark at will, so that the skeleton seems to vanish and reappear. By using different powders with the emanation I can produce fluorescence of different colors. But what is the use of explaining. To-morrow night you will get a practical demonstration."

CHAPTER III

In the rebel camp there was great activity, for the morrow was to see the first real battle between the Arab and negro troops and the enemy's soldiery. General Blank, at the head of the government army, had received orders to try conciliation, and under no circumstances to commence or provoke hostilities, but he realized full well that the rebels were massing their forces and that the morrow would see the first real hostilities. He had only scorn for Doctor Hackensaw's project of frightening the natives, but he placed all facilities at the doctor's disposal.

And that night, about midnight, the walking skeleton made its first appearance in front of the rebel camp. The sentinels suddenly saw appear before them a giant skeleton with luminous bones shining with a baleful greenish fire! The skeleton uplifted its hands and came forward, its jaws working, as by means of an amplifying device it thundered forth the words: "Balek! Balek! Balek!" the Arabic equivalent of "Beware! Beware! Beware!" The sentinels shot at the figure and it suddenly vanished from their sight with a loud mocking laugh, and then reappeared some distance away and repeated its cry again. The whole camp was now up in alarm, and they all saw with terror the figure appear a third time. Then it vanished and was seen no more that night.

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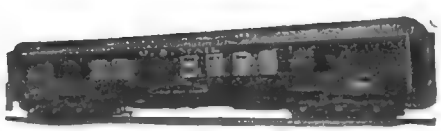

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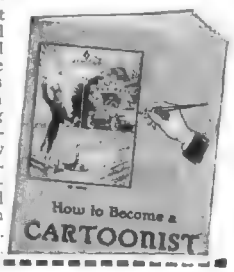

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"I'll give them a second dose to-night," said Doctor Hackensaw. Accordingly, sharp at midnight, the skeleton appeared again. This time, however, it was mounted on a skeleton horse with wings. And this time the luminous emanation shot forth from all parts of the figure in jets of colored fire like the coronal streamers of the sun. And this time the phonograph sent forth peals of reverberating thunder, while lightning flashed at intervals from the figure. And as it circled over the rebel camp it discharged upon them gases with a fearful stench. A combination of asafoetida, skunk fluid and Limburger cheese would have been like Attar of Roses compared to the horrible smell emitted by the figure, while the words: "Maout! Maout! Maout!" came from the skeleton's moving jaws—the Arabic equivalent of, "Death! Death! Death!"

The natives in terror all fell upon their knees, and at once sent messengers to General Blank, tendering their submission. As a result, the following night there appeared a flying cherub over their camp and scattered fragrant jessamines among the natives—a flower of which the Arabs are very fond. The uprising was at an end. Doctor Hackensaw in two days, at a trifling expense, had accomplished without bloodshed results such as a large army could not have accomplished in months and then only at the expense of many thousands of lives and millions upon millions of dollars!

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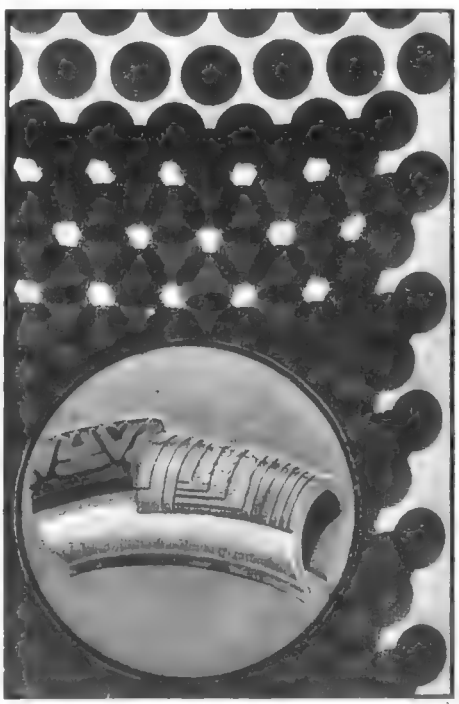

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Reader's Forum

(*Continued from page* 1109)

LIKES S AND I

Editor, *Science and Invention:*

Allow me, as a sincere reader of SCIENCE AND INVENTION, to give my personal estimation of your publication. I was a reader of many scientific periodicals, expecting to gain some knowledge from them. Instead of learning something from them, I was only more confused after reading them. I then decided to center my subscription on one magazine. Naturally I had to look for the best scientific magazine published for my subscription. After a deep search I found that the magazine with the golden cover was to be my selected magazine. I have never regretted the day I sent in my subscription.

A magazine like SCIENCE AND INVENTION, containing no long, lengthy articles, but illustrations and explanations perfectly clear, written in good English, publishing only worthwhile important articles, publishing no thick issues with nothing in them, has no contemporary superior. For school, work, and my own laboratory experiments, it is a veritable storehouse of reference. For interesting reading it has none superior in its field. Let me take this opportunity to thank and congratulate the editors, contributors, and all connected with this company for their earnest labor in publishing a magazine so fine as SCIENCE AND INVENTION.

LEONARD KALSON,
Pittsburgh, Pa.

(Thanks, Mr. Kalson, it is very nice of you to give credit to us for our efforts in giving you what you want, and we are glad to know that in another case we have succeeded.

The rapid strides in increased circulation further indicate our success in pleasing our readers. We hope we shall continue to merit your praise and if we don't, just tell us.—Editor.)

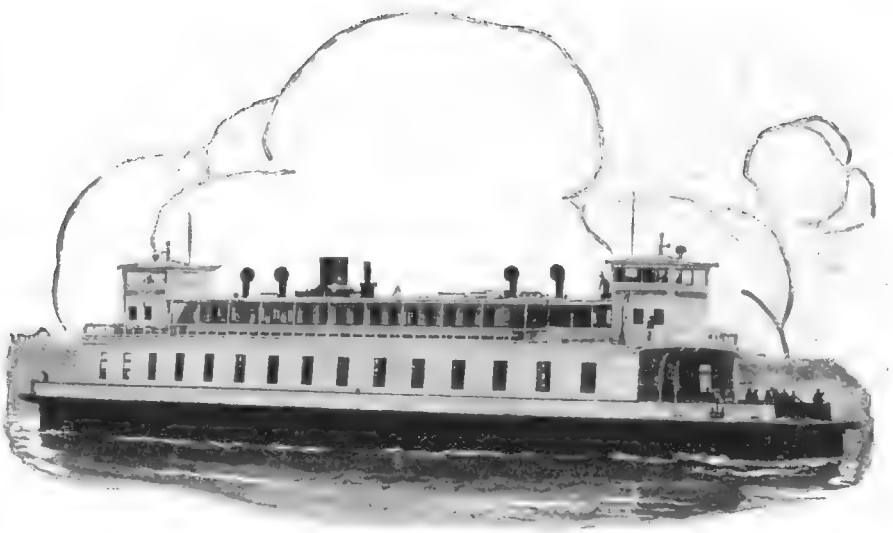
THOUGHT WAVES

Editor, *Science and Invention:*

For a number of years I have read your magazine and have always found it interesting and stimulating. Now, I would not go without it. I have met some people who appear to think that some of the "stuff," as they call it, in the magazine is of little or no value. I am referring to those articles that are dealing with what I may perhaps term scientific imagination. I belong to those who believe that the dreams of the scientific thinker of today are the realities of tomorrow. I believe that your magazine cannot fail to act as a powerful spur on the imagination and efforts especially of the young scientific reader and inventor. That, I believe, is one of its greatest missions.

But now, I would like to have your opinion on some ideas that I have had in mind for some time. It is now believed by many that when a man thinks, some material changes are taking place in his brain. In their nature these changes may be molecular, atomic or electronic. If so, they may be considered as energy in a material sense and in that case they will produce waves in the ether. Now, if we assume that nothing is lost in the universe, this energy, in the form of ether waves, must go on through space forever. Then, in this respect they are analogous to the waves of heat, light, electricity and for aught we know, gravitation. If this is correct, then every thinking brain is a broadcast station in a real sense. Hence, we are receiving energy in the form of thought waves from all directions, not only from this planet, but from every inhabited planet in space.

Would it not be reasonable to believe that an instrument could be constructed that could register these waves and amplify and even transform them? Some claim that the brain, under conditions, can act as a receiving station. Our instrument could, therefore, be constructed along lines already laid out by nature in building up the human brain. We have such instruments now. The camera is one of them. The eye being an optical instrument registers certain kinds of energy waves and transfers them to the brain, which translates them in terms of vision. Our instrument need not necessarily be a thought-reader in detail. But it could well indicate the general trend of one's thoughts, whether they be good or evil. It would be useful to indicate the combined thoughts of large groups of individuals, as the transactions of a large company or the manoeuverings of a political party or, as between nations, such important questions as a choice between war and peace. The owner of such an instrument would know instantly and accurately about many things that it would take others thousands and millions of dollars to find out. As for communication with other planets, almost infinite possibilities would be opened to the investigator. For example, that which is seen by a brain on another planet is by that brain broadcast through space in the form of waves. These waves are received by our mechanical brain here on earth, amplified, transformed if



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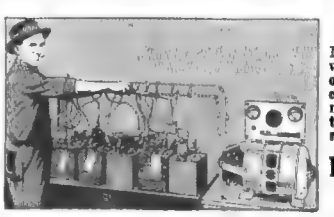

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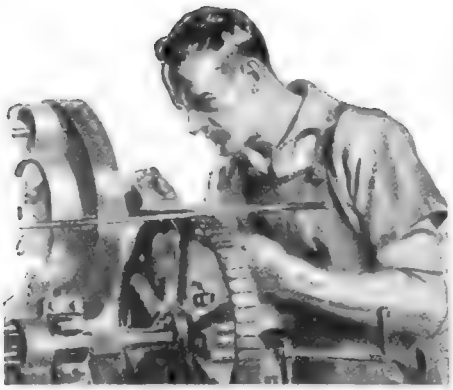

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ARTHUR JOHNSON,
Portland, Oregon.

(Mr. H. Gernsback, editor of this magazine, showed the possible construction of such a machine called the "thought recorder" in the May, 1919 issue of SCIENCE AND INVENTION MAGAZINE, *Then known as The Electrical Experimenter. Up to the present time no one has demonstrated such a machine and it is possible that the device will not appear for years to come because we do not as yet know what thought "waves" really are or if they exist. Several claims for the construction of a device of this nature have been made, and one man has even taken out a patent on the system of doing just this, but even those claims must be ignored on the basis of the fact that the results cannot be duplicated by identically similar apparatus. The inventor himself has not thought it wise for reasons best known to himself to give demonstrations of the system in operation. Many of his supposed scientific statements are at such variance with known scientific facts and laws, that his claims must be seriously doubted.*

The successful inventor of such a system will undoubtedly reap fortunes for his idea and will perpetually inscribe his name in the Hall of Fame for making the most worthy scientific contribution of the era. Medical science will likewise make an important advancement based on the demonstration of the principle of such a method. —Editor.)

NOT A QUITTER

Editor, SCIENCE AND INVENTION:

"Your prize contest is positively unfair." Some of your contributors seem to be so lacking in sound judgment as to permit that uncanny thought to creep into their minds, and finally into a hot package for the editors. I have the same reason to make the same assertion. However, it is a simple fact that any and every contribution can't be accepted. The result of accepting too many would be a disastrous waste far greater than would be suspected. Out of seven contributions I have not yet had an acceptance, but I am not going to be a quitter. My motto is, "Once in the game, never get yellow." I find a rejection to be a universal pointer to attainment of perfection.

JOHN M. SKEEN, Lake Creek, Texas.

(You are right, Mr. Skeen. The judges have a difficult and sometimes, we think, a thankless job in awarding prizes. They try to do their very best, and all decisions are unanimously voted. Of course, it's an absolute impossibility to please everyone all the time, but then those that get the prizes haven't even as much as entered one single complaint. Evidently, we pleased more than 13,000 people last year in addition to a steadily increasing number of readers.

*We are glad you intend to try again, and hope you will be successful to the extent of winning a healthy sized check.—*EDITOR.)

A SATISFIED READER

Editor, SCIENCE AND INVENTION:

I have been a reader of SCIENCE AND INVENTION for many years and even though I may travel all over the earth, I always get a copy even if it is many months old. I have seen many magazines all over the world, but not one equal to SCIENCE AND INVENTION since the elimination of many words and subsequent explanation by the pictures. Once in a while I read many complaints from our friend readers and I want to say right here that they would be better off if they would stop to think before they complain. Many fire their guns at Mr. J. H. Kraus of the Patent Advice Department because he gives them the right advice. Twice Mr. Kraus advisd me not to apply for patents on two certain inventions and on the third one I refused to listen and now I am short about $150.00. I read the "whys" of our friend reader from Spokane, Wash., Elsie Brierheath, and if she desires to have a longer answer than yours, she can find same in the Cosmopolitan Magazine of October, in an article by Rupert Hughes. Mr. H. Gernsback's admonition, "Those who refuse to go beyond fact rarely get as far as fact," should be gold plated and placed in the bed-rooms of every SCIENCE AND INVENTION reader.

PAUL MITCHELL,
U. S. S. *Sumner,* San Diego, Calif.

(Sorry you had such trouble with your invention. SCIENCE AND INVENTION *magazine never advises that a patent be applied for unless the device is of probable financial value to the inventor. We try to weigh each and every argument in favor of the inventor and then look at the other side of the same story. If one pan of the balance is heavier than the other, we try to follow such indication. If correction is impossible, we advise against attempting to patent the device upon which the request for advice is made.—*EDITOR.)

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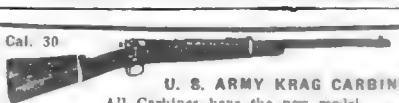

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Book Review

THE YOUNG CHILD'S HEALTH, by Henry L. K. Shaw, M. D. FOOD FOR HEALTH'S SAKE—WHAT TO EAT, by Lucy H. Gillett, M. A. THE QUEST FOR HEALTH, by James A. Tobey, M. S. THE HUMAN MACHINE—HOW YOUR BODY FUNCTIONS, by W. H. Howell, M. D. TAKING CARE OF YOUR HEART by T. Stuart Hart, M. D. Flexible cloth covers, size 4 inches by 6 inches each, 50 to 75 pages each, published by Funk & Wagnalls Co., New York City.

An association composed of various other societies for the improvement of the public health, named the National Health Council, is publishing a series of most attractive little books on the various subjects relating to health. The best way to give our readers an idea of what is being done, is to say that when completed there will be twenty of these little manuals, with about sixty or seventy pages to each. Special subjects treated and to be treated, include the baby's health, the heart, cancer, man and the microbes, tuberculosis, etc. Each one of these little treatises, and there are more to come, is written by specialists, and it seems certain that the needs realized or not realized of almost everyone of us, will be reached by some of the twenty manuals. The printing is effective, and the binding and general make-up is quite attractive and a good example of how to produce such a series.

ESSENTIALS OF PRINTING. By Frank S. Henry, 187 pages, cloth covers, illustrated, 7¾ x 5¼", price $1.25, published by John Wiley & Sons, Inc.

Who has not looked at a printed page and wondered how the printer that set up the type could get the righthand margins so even and not have them staggered as in ordinary typewriting? The art of printing is simple, yet to the layman it seems rather complex. This work of Mr. Henry's puts forth the main points of printing in a simplified manner.

He begins at the very beginning of the subject and describes type and type cases. The pages then go on to describe the process of setting up type by hand and the method of spacing the type so that the ends of the line are even and the work is "justified." Throughout the work, type sizes and fonts are described. The measurements used in printing are detailed and their various uses fully dealt with. From then on the beginner is led through various stages such as the making and correcting of proofs and the use of various machinery which makes typesetting faster and easier.

Page composition is then dealt with and various illustrations show how a set up page is to be placed in the press and printed. The last chapter deals with the paper used in printing and classifies it as to size and weight.

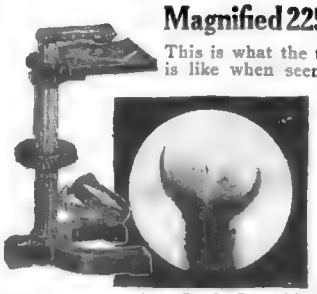
This book is valuable to anyone interested in learning the printing trade as it is elementary and simple to understand. It deals entirely with hand type setting and does not describe linotype or monotype machines. However, as a text book for the beginner it has an excellent place and can be heartily recommended as an authoritative work.

DETAILS OF TYPICAL MECHANISM. By C. M. Linley, 103 pages, cloth covers, illustrated, price $2.00, published by the D. Van Nostrand Publishing Co., New York City.

The mechanic or inventor very frequently desires to obtain the mechanism which will do a certain work in the simplest manner, but has no way of finding out just what type to use. This volume is intended to do away with such difficulties as it explains in detail most of the common types of mechanism used in all classes of modern machinery. Each and every device is completely illustrated and fully described in the text. As an aid to a student of mechanical engineering or in fact of any type of engineering or to the inventor, this book should prove a great help.

FLYING. By Major W. T. Blake, 221 pages, 7½ x 5", published by George Allen & Unwin, Ltd., England. Price, six shillings ($1.50).

To the general public, the science of aviation is somewhat of a mystery and as such it receives little or no attention. Aviation is a subject which can be made extremely interesting if presented in the proper light and everyone at all interested in science in general will welcome this new volume. The reason is that the book is written for the layman and for those who do not have a deep



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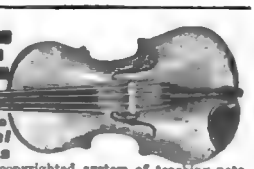

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knowledge of mathematics and other subjects which enter into the design and construction of airplanes.

Major Blake in treating the subject considers the future possibilities of aircraft. He next takes up the construction of airplanes both land, sea planes and flying boats. One chapter is devoted to a discussion of the fundamental principles underlying airplane construction, but no complicated formulas are given, as it is only intended to present the main points of the subject. Further on in the volume, a short resumé is given telling just how a pilot operates an airplane under different conditions and gives the physical characteristics which a person must have in order to become a successful pilot.

Other subjects touched upon are the construction of aerodromes and air terminals for commercial flying and the effect of atmospheric conditions on the possibilities of flight.

The author's knowledge of flying enables him to make many suggestions toward the improvement of flying conditions as well as of airplane engines and parts. He discusses in a very clear and concise manner the principles of the different types of airplane engines in use today.

A further chapter is devoted to the subject of gliding and in it the principles involved are discussed and also the relation of gliding to flying with motor-driven airplanes. He considers the science of gliding to be very valuable for the aviator, and he points out how gasoline can be saved by making use of air currents in the proper places and allowing the plane to glide with the motor throttled very low.

Taken as a whole, the book is an excellent treatise on the subject of flying and the manner in which it is written will make it a valuable addition to the library of anyone interested in aviation.

FOIBLES AND FALLACIES OF SCIENCE. By Daniel W. Hering, C. E., Ph. D. LL. D., illustrated, 294 pages, 8¼ x 5½", price $2.50 cloth covers, published by the D. Van Nostrand Publishing Co., New York City.

Although perpetual motion and kindred subjects are products of the medieval ages, still it is surprising to note the wide interest which they command among present day inventors and mechanical workers. As the author of this work rather broadly states, it seems that practically every person you meet, who is at all interested in mathematics, either has in his mind at that time or has had an idea about perpetual motion which he fondly believes is workable. And perpetual motion is not the only fallacy that engages minds today, as there are still to be found many believers in such subjects as astrology and the divining rod.

In the book at hand, the author has touched on almost every one of the features indicated by the title in an authoritative and clear manner. Perusing this volume would undoubtedly quench the desire of hundreds of searchers for perpetual motion and the philosopher's stone. Explanations of many devices are given and reasons are assigned to each one showing just why it will not work.

A glance through the table of contents reveals the wide range of subjects covered in this interesting volume. Some of them are astrology, transmutation of metals, perpetual motion, divination, hoaxes, prophecies, charlatanism, and other ancient chimeras such as the universal solvent.

To review thoroughly the treatment of the subjects in this excellent work would require too much space. It is sufficient to say that the book is wonderfully interesting and it is well worth reading for the general information contained therein. If more of our readers who are convinced that perpetual motion is a possibility would read this volume and consider it seriously, we are sure that they would change their ideas.

PIONEER INVENTIONS AND PIONEER PATENTS. By Frank Keiper. 152 pages. Cloth Cover. 10¾" x 7¼". Published by Pioneer Publishing Co., Rochester, New York. Price, $3.00 net.

The book is written from the manuscript of a lecture delivered to students at Purdue University. The author is a member of the patent bar and is a well known advocate. In this work, the subject of patent law, usually considered as a dry abstract subject, is treated in such a manner that it becomes interesting reading. The author begins his book with a resumé of pioneer inventions in different fields of endeavor, covering points that we of the present day do not often look upon as inventions. Chief among these is the alphabet in use today.

Following this are several pages devoted to the reproduction of various basic patents on such well-known subjects as the telegraph and rubber vulcanizing. Many points in connection with radio vacuum tubes, which have received much notice of late, due to patent litigation, are brought forth. The second part of the book is devoted to a discussion of the various problems confronting the inventor and tells how some of them may be overcome. Directions are given for the recording of patents and for the selling of same.

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The book is very well written throughout, and should be of great assistance to the prospective inventor as well as to anyone at all interested in patent law.

AUTOMOTIVE CONSTRUCTION AND OPERATION. By J. C. Wright and Fred C. Smith. 446 pages. Cloth cover. 9¼" x 6". Published by John Wiley & Sons, Inc., New York. Price $3.00 net.

The subject of automotive construction and operation is such a broad one, due to the many types and makes of automobiles on the road today, that it takes a very well planned book to cover the subject intelligently and thoroughly. This book does just that. The subjects are so arranged that, beginning at the front of the book, each and every one is treated in the proper sequence. A short historical survey is first given, and then the various types of automobiles are considered. The power plant and how it operates is treated in detail and each and every part of the engine is described. A survey of the fuel question is then given and various fuels other than gasoline are mentioned. The chapters following deal with the functions of the various parts of the car's plant, such as the carburetor, the ignition system, and cooling system. In one part of this book will be found an excellent treatise on automotive electricity, covering the principal systems used and describing each one.

The last chapter of the book is one which will be found to be of great value to anyone at all interested in this subject. It is headed "Useful Information" and contains data on various topics classified in such a way that any particular subject is very easy to find. The facts given in this last chapter are well worth the price of the book alone. Many of the matters so treated are of great assistance when looking for trouble with an engine.

The book is written in such a way that it is of great value not only to the layman who expects to purchase a car, but also to experienced drivers and mechanics.

HOUSEHOLD PHYSICS. By Joseph M. Jameson. 437 pages. Cloth cover. 8" x 5¾". Published by John Wiley & Sons, Inc., New York. Price $1.90 net.

In the library of every person interested in science in general or in any one science in particular, there must be at least one or more books devoted to the subject of physics. In every science, there will be found one or more points depending entirely upon various laws of physics. A book of a type such as this one is very valuable. It contains much information, but the technical points are so expressed that they can be understood by practically everyone. True enough, all the subjects are treated with their household applications in view. This, however, tends to make the book very interesting as it connects up various scientific facts and theories with our everyday life. Such subjects as heat and methods of heating homes are discussed in detail. Then what in a sense is the opposite subject, refrigeration, is discussed. Ice boxes and refrigerating machines are described and thoroughly illustrated in detail.

Next the subject of electricity in the home is treated in a very simplified manner. The uses of electricity for heat and the electric power used by household appliances are given, and hints for the efficient operation of various devices are described. The subject of color and its relation to artificial lighting is taken up, and discussed and treated in detail.

Then such everyday subjects as water meters and various household measures and scales are described and their shortcomings pointed out.

Taken as a whole, the book is one which merits careful reading. As an assistance to the High School student, its value can not be underestimated. Also for those who are through with intensive education, but who desire to keep certain facts available, this book will be found of great value.

STORAGE BATTERIES. By George Wood Vinal. Hard cloth covers. 9¼" x 6". 394 pages. Price $4.50. Published by John Wiley & Sons, Inc., New York City.

Although storage batteriese are very common things, and their form and use are well known to everyone, still there have been a comparatively small number of books and very little authoritative literature published on their design and construction. The book before the reviewer at this time, makes up for all the former scarcity of material on this subject. It is the fullest book on the subject of storage batteries that has ever come to our attention. It describes every possible point in connection with the construction of storage batteries and discusses each point in complete detail. All the various types of batteries are considered

(*Continued on page* 1149)

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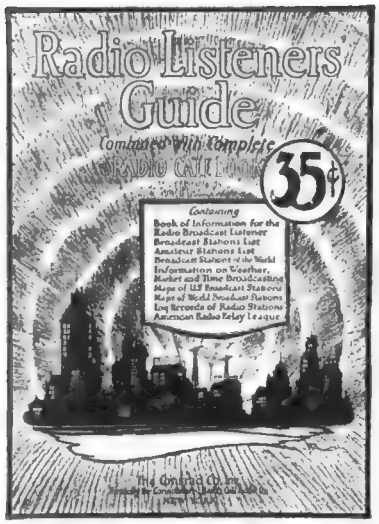

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and their component parts illustrated and described in full. In this work one can find almost anything he desires to know in connection with the manufacture, the care and the charging of storage batteries. The difference between various types of batteries is discussed and the kind of battery that is particularly suitable to any certain work is mentioned and the reason for the choice is given.

This book should be of very great value to anyone engaged in work where he has continual contact with storage batteries. Also the layman, the student of electricity and the experimenter will undoubtedly want this book in his library. It contains page after page of useful information and data that cannot be found readily elsewhere.

LIGHT. By H. M. Reese. Hard cloth cover. 9¼" x 6". 295 pages. Published by the Missouri Book Company, Columbia, Missouri.

Although to the average layman light appears to be an exceedingly simple subject, still the student of physics finds that it is very much more complicated than would at first be imagined. This book on light delves deeply into the subject instead of just skimming the surface as many books do. Furthermore, it is written in a rather simplified form, for as the author states, it was planned for students who have never had any training in calculus. The book starts with the usual introduction, covering the velocity of light and the methods used in studying the light waves. From there on, the text becomes more complicated as reflection and the various types of mirrors are dealt with. Lenses, telescopes and projection lanterns are discussed in detail and the principles upon which each depend are outlined. Throughout the volume, methods of studying the construction and effects of light are continually described and profusely illustrated. The book is one which should be of interest to all students of physics and to those who are particularly interested in astronomy.

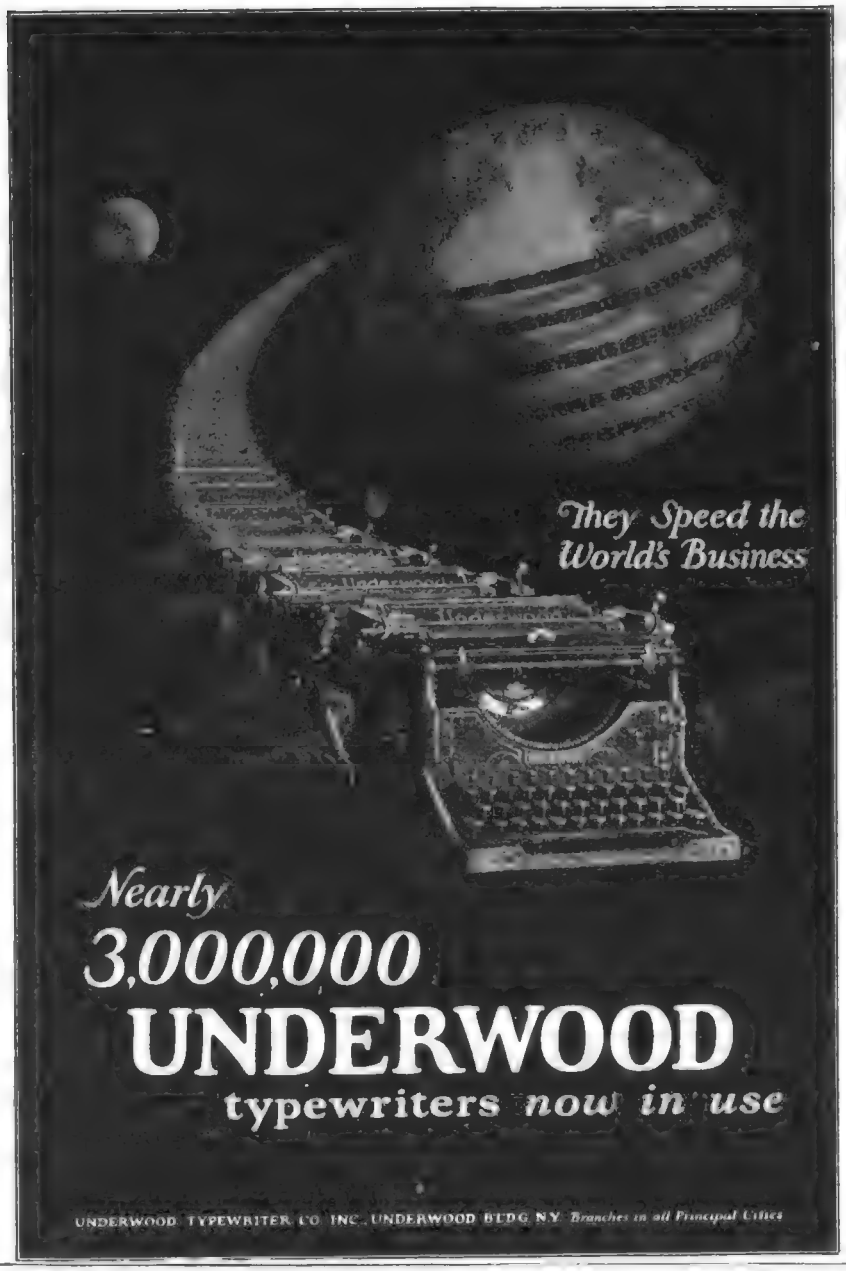
THE POULSEN ARC GENERATOR. By C. F. Elwell, B.A., E.E. Hard cloth covers. 8½" x 5½". 192 pages. Published by the D. Van Nostrand Publishing Co., New York City. Price $4.00.

Although the author of this book states in the preface that it is not intended to be a technical treatise on the Poulsen arc generator, it does give the theory of that generator in a simplified and concise manner. The greater part of the text is given over to the account of the history of the Poulsen machine.

Those radio experimenters who are familiar with or interested in the C.W. transmission as accomplished by the use of vacuum tubes, will find much of interest in its pages. It deals with the machine which enables radio transmitting stations to employ a power of 25 kilowatts and higher, a feat not usually and economically obtained with vacuum tubes. In the days before broadcasting, the whine of arc stations was familiar to every receiving fan. Today but few of those interested in broadcasting ever listen to the stations that carry on the most important traffic in radio. These are the larger commercial and government stations which are continually transmitting press news and business messages across oceans and continents. The Poulsen arc generator is the heart of many of these stations and as such is certainly deserving of a place in the history of radio. This volume attempts to place the arc generator in that niche of fame and accomplishes the purpose quite well.

EVOLUTION. By Vernon Kellogg. Octavo, stiff cloth covers. 291 pages. Published by D. Appleton & Co., New York. Price $1.75.

Ever since William Jennings Bryan began his crusade to put down evolution in the schools, there has been a veritable flock of ideas on the subject, some good, some bad, from the hands of more or less eminent men. The present volume by an author well known to followers of this column, is among the best for the lay reader that has come to our hands in some time. His method of organization in the volume is particularly adapted to the reader who lacks the time to go into the subject in a professional way. The first chapter is an explanation of evolution, something which has long been lacking, that is, as far as the lay reader is concerned. One finds that the development of man from the anthropoid ape is not the primary thesis of this great doctrine in spite of various Christian though unenlightened gentlemen. Then follows a number of chapters dealing with evolution in the several divisions of life, which includes a section on plants, vertebrates and invertebrates, and lastly homo sapiens, with conclusions on societal evolution and a prospect for the future.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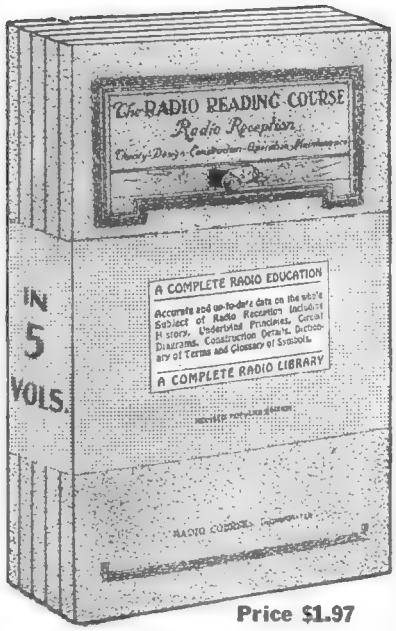

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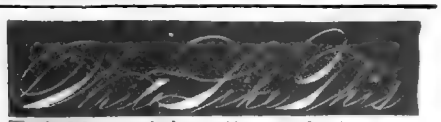

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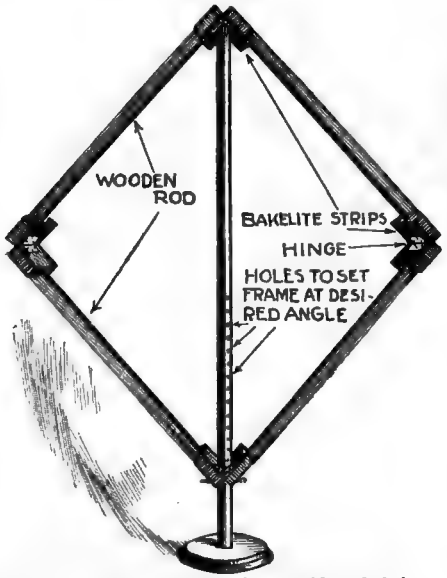
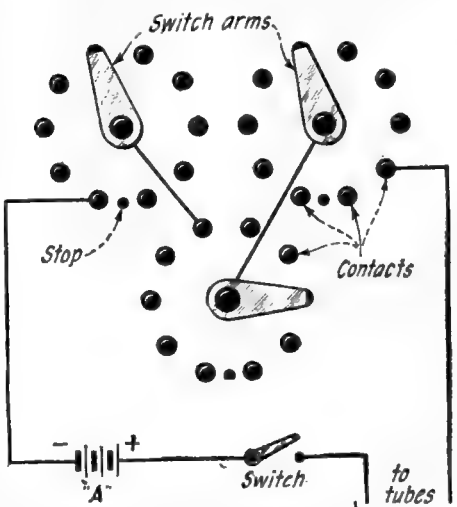


A loop antenna which is capable of being tuned by varying the area of enclosure by means of holes in the frame, allowing its lower portion to be raised or lowered, is readily constructed in the above manner. For the average broadcast wave-length 15 turns of No. 18 wire wound on a form 3½ feet square will do nicely.

—Thos. E. Perdue, Reporter No. 5376.

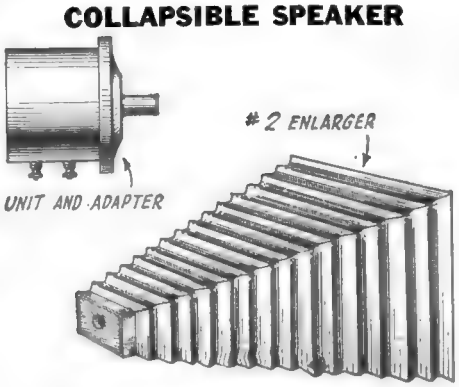
COMBINATION SWITCH



When little Willie starts "monkeying," it is high time to provide the set with an arrangement which will render it difficult for him to burn out the tubes or run down the batteries. Here is how to do it. Caution—don't forget the combination!

—George Vatcher, Reporter No. 9608.

COLLAPSIBLE SPEAKER



A portable loud speaker is something which is often desired and harder to procure. By using a collapsible camera enlarged bellows, the problem is solved. Fitting a loud speaker unit to the end of the bellows completes the arrangement which gives very satisfactory results.

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When grandfather was a little boy

EVERY fall there would come a day when his mother would say to his father, "John, it's time to see about the children's shoes."

Shoes were matters to reckon with in great-grandfather's family. As in many other families of the countryside, calves had to be killed and skinned. The skins were taken to a tannery across the river, and in due time young John would set off with the leather to the cobbler to have his measure taken.

Old Sam, the cobbler, was a friend of the family. They knew him. They knew his work. They knew the quality of the leather they had furnished him. They could have estimated pretty accurately the time young John's shoes would wear him.

Those days are gone forever. No longer do you know personally the makers of your shoes. Your clothing, your food, your furniture, your household utilities are produced by men and women you will never see.

That element of confidence, however, which in former days came from personal contact of neighbor with neighbor and friend with friend is still present.

Nowadays, advertising is the bond between manufacturer and consumer; between merchant and patron.

Through advertising, maker and dealer build with you their reputations.

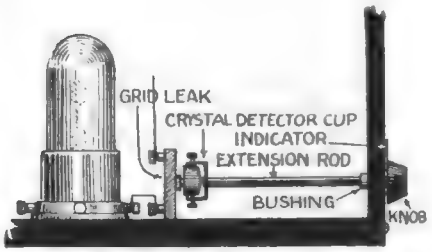
Through advertising, they make a bid for your friendship.

To them, your friendship is essential, and to assure it, they see to it that their goods are as advertised.

By reading advertisements, you *know* where and what you can buy with confidence.

In buying advertised goods the element of risk is removed

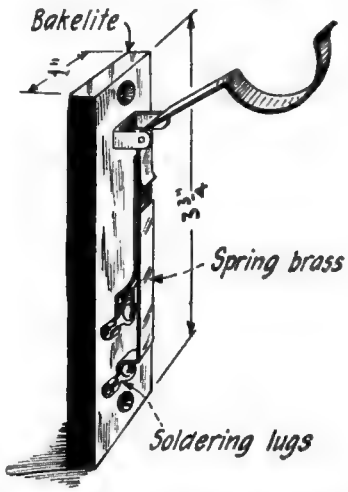
GRID CONTROL



Inasmuch as it is best to keep the grid connection as short as possible and away from the panel, the grid leak is provided with a long fibre extension rod which allows of minute adjustment, and "remote" control.

—Boyd G. Switzer

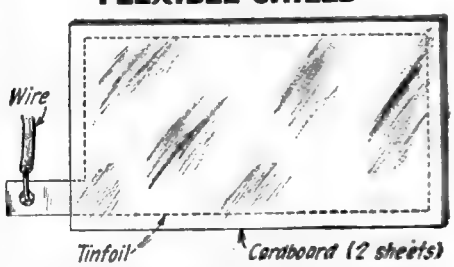
FILAMENT CONTROL



Another way in which the running down of batteries may be avoided is through the use of a simple phone hook and filament control switch combined. Three pieces of spring brass are bent into the shapes as shown above and connections are made so that when the phones are placed on the hook, the storage battery is disconnected.

—Floyd W. Peters.

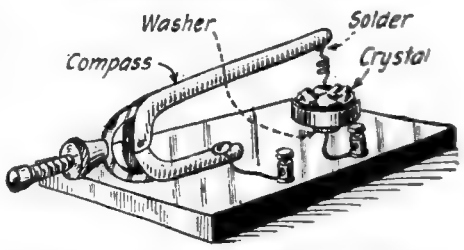
FLEXIBLE SHIELD



Flexible shields can be made in any size to suit specific needs. They are very helpful in shielding the different instruments of a set and are superior to the large metallic shields. They are made by pasting a sheet of tin foil between two sheets of Manila paper or cardboard, of the required size.

—Chas. F. Felstead, 6CU.

COMPASS DETECTOR



Again, the much abused dividers or compass finds employment, this time, as a very fine adjustable detector unit. One leg of the compass is cut off short and is fastened as shown. Adjustment is made by rotating the knurled knob.

—Lloyd Mallett.

Ford Runs 57 Miles on Gallon of Gasoline

A new automatic and self-regulating device has been invented by John A. Stransky, 29 Fourth St., Pukwana, South Dakota, with which automobiles have made from 35 to 57 miles on a gallon of gasoline. It removes carbon and reduces spark plug trouble and overheating. It can be installed by any one in five mniutes. Mr. Stransky wants distributors and is willing to send a sample at his own risk. Write him today.—Adv.

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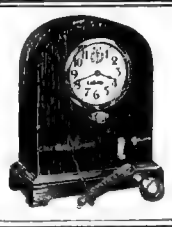

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Answers to Scientific Problems

(*Continued from page* 1100)

PUZZLE PICTURE

The image of the man should face the same way that the man does. It should appear to be directly behind the mirror and of the same size as the man. The figures on the dial of the clock should appear reversed.

The angle at which the ray leaves the mirror should equal the angle at which it strikes the mirror and a plane in which the incident and reflected rays lie should appear to be perpendicular to the face of the mirror.

The passage of a ray of light through the prism is incorrectly represented for a ray on striking a prism from the direction indicated will be deflected toward the thicker portion of the prism and not toward the corner as represented in the picture.

SWATTING BUMBLE BEES

It is difficult to swat a bumble bee with an unperforated paddle because the movement of the paddle tends to set air currents sweeping around the side of the paddle which carry Mr. Bumble Bee with them. If holes are drilled in the paddle, some of the air at least moves through the holes and thus carries the bee against the paddle.

DAY AND NIGHT

The day appears to average longer than the night because of the refraction of the atmosphere which makes the sun visible in the morning before it has actually cleared the horizon. For the same reason the day is lengthened in the evening, the total effect being to increase the day by from four to eight minutes.

THE BOXES OF BALL BEARINGS

If the boxes are equally well packed, they should contain the same weight of bearings, for if the radius of a bearing is r inches, one could pack L/2r bearings along each dimension or $L^3/8r^3$ bearings in all (L being the length of one edge of each box). Now the volume of each bearing would be $4/3\ \pi\ r^3$ and the volume of all the bearings in any one box would be $L^3/8r^3 \times 4/3\ \pi\ r^3$ or $\pi/6\ L^3$ cubic inches. But since r, the radius of a bearing does not appear in this expression for the total volume, it is evident that the volume of steel enclosed in each box must be the same regardless of the size of the bearings. Hence, the weight of each box should be the same.

THE FALLING TANK

If the tank and contents fell freely, that is with the acceleration due to gravity (980 cm. per sec. per sec.), the tank, water, block and all would cease to weigh anything. The water would not exert any pressure on the bottom of the tank or anywhere else for that matter, and so it could not exert any buoyant force on the cork. The cork would then remain submerged even after the cord was severed.

CYCLONES AND TORNADOES

Cyclones and tornadoes are terms often used to mean the same thing. Technically, however, they are quite different. The term "cyclone" should be applied to a storm, periodical in occurrence, of large area, about a thousand miles or so in diameter. It is of common occurrence and not necessarily violent or destructive. A tornado, on the other hand, is a much smaller and more violent storm of brief duration and causing only local disturbance. The picture represents a tornado.

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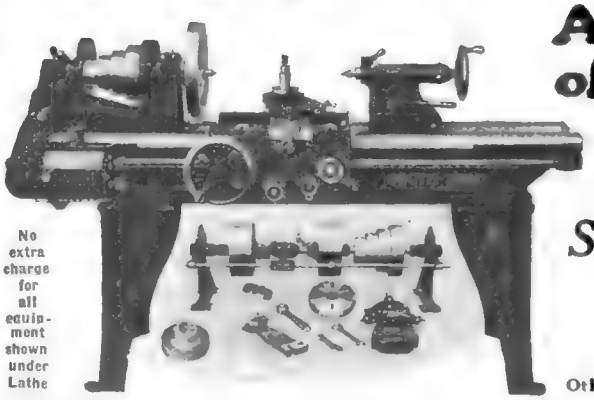

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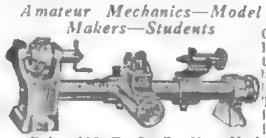

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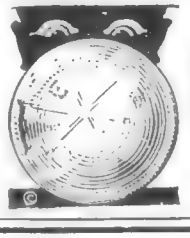

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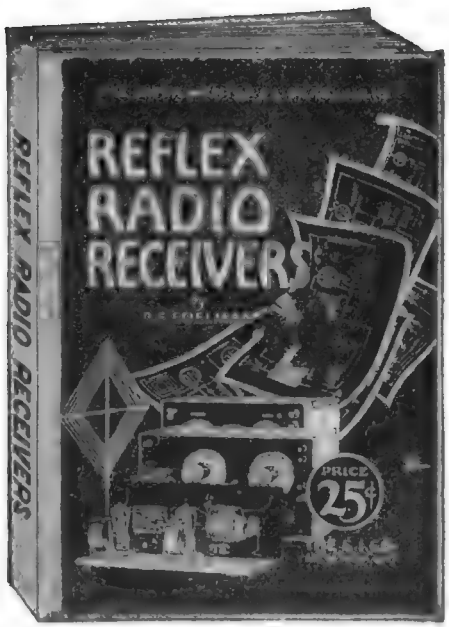

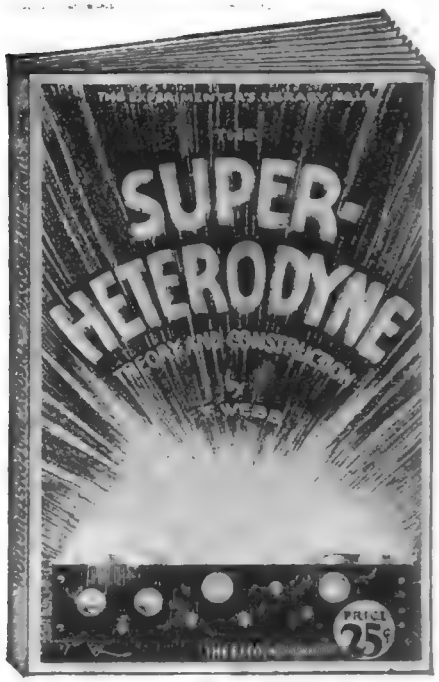

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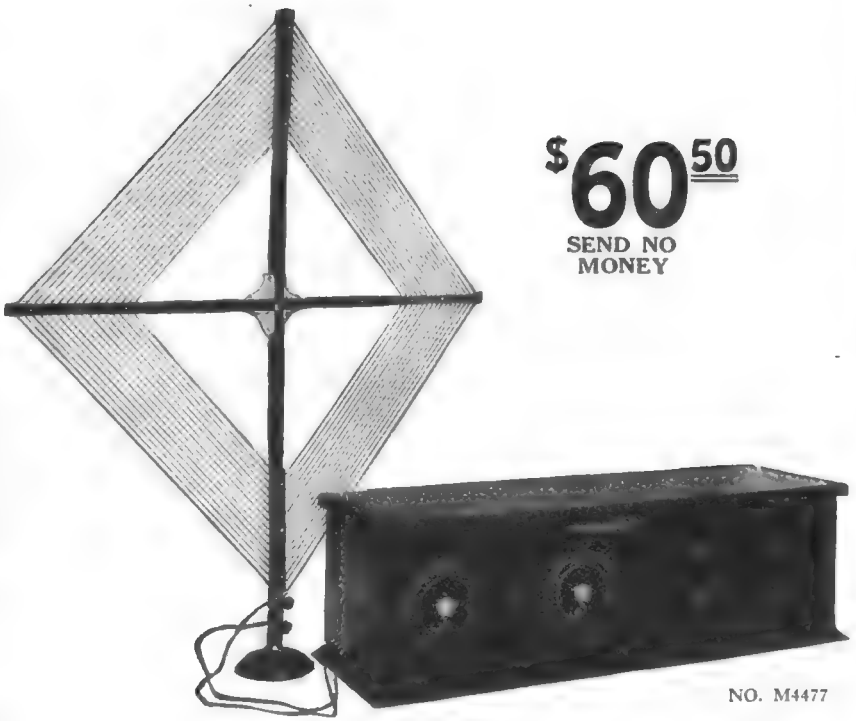
The outfit advertised here is complete, as listed below, everything needed is included, down to the last screw. The charts, blueprints, directions and photos furnished are so complete and explicit that anyone can build this set and have it working within a few hours. There is nothing additional to buy except the necessary batteries and tubes. Price includes mahogany cabinet and folding loop aerial.

You can pay $150 or more for an outfit, or $200 or more for a set, but you cannot possibly buy a better set than this one.



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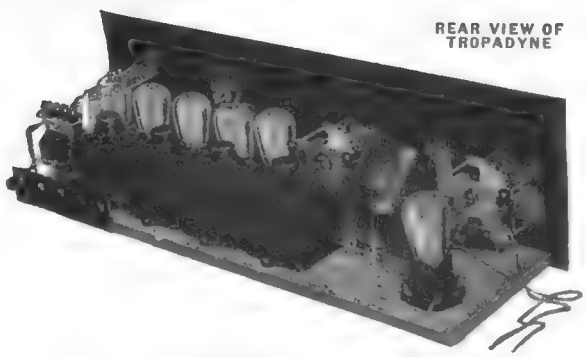

REAR VIEW OF TROPADYNE

Note These Important Features:

DISTANCE, VOLUME AND TONE QUALITY equal to any 8 tube set sold anywhere at any price.

LOOP RECEPTION—Outside aerial not to be used with this set—the complete loop is included in outfit.

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MICROMETER VERNIER DIALS giving you the full advantage of the exceptionally sharp tuning.

OUTFIT IS ABSOLUTELY COMPLETE—Drilled panel, Mahoganite Cabinet and everything else needed, except tubes and batteries.

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The Editor of Radio News

In the August 1924 issue, said this about the **Tropadyne**: "Here is a remarkable receiver which we warmly recommend to our readers. It has several new and unusual features. In the first place only 6 tubes are used giving as much volume as the average 8 tube Heterodyne. The selectivity of this set is unusual. Unequalities of the intermediate transformers have now been done away with by tuning each transformer. After the transformer has been tuned, it can be left this way, no further tuning being necessary.

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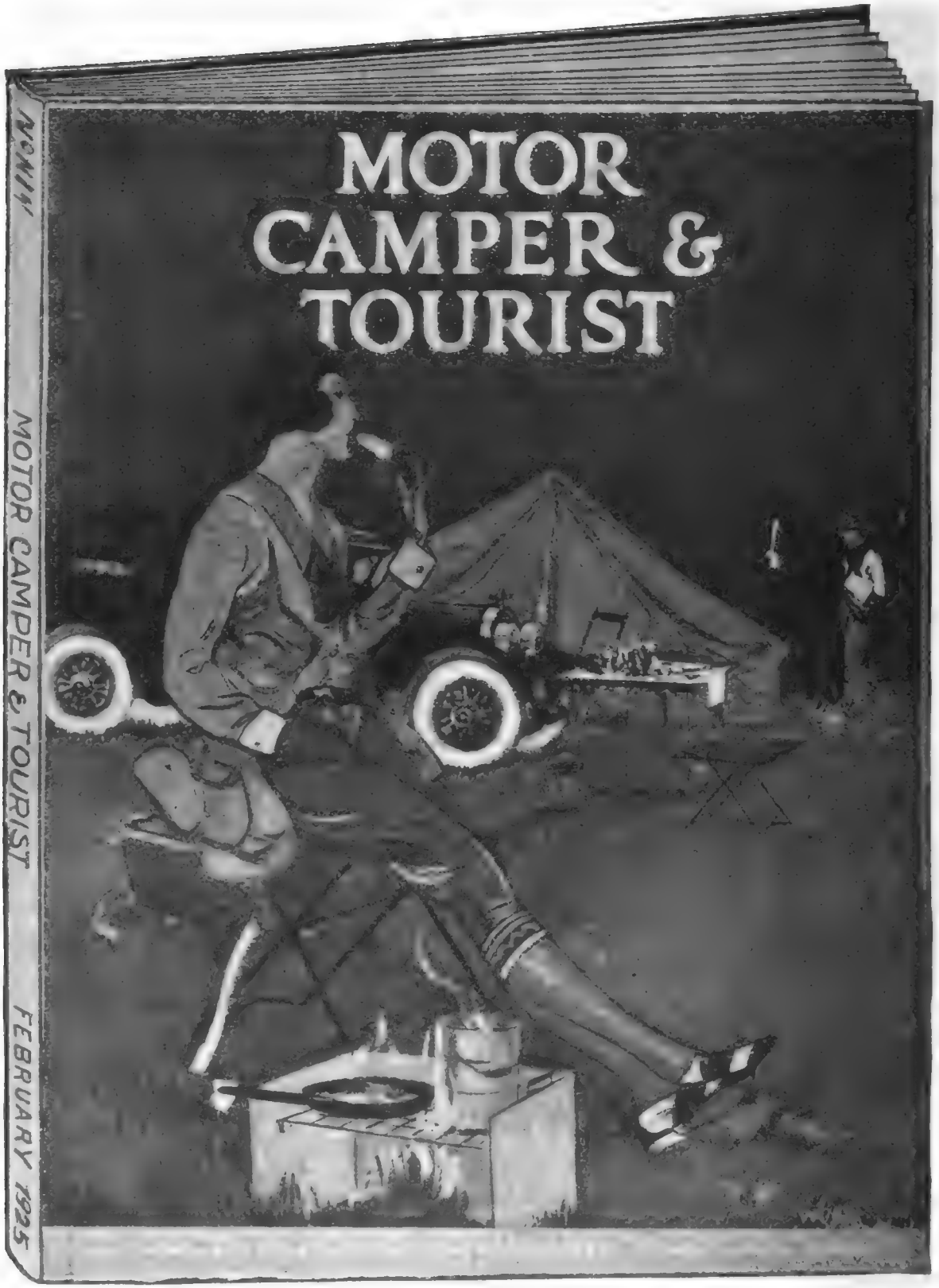

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Answers to Scientific Problems

(*Continued from page* 1155)

COLOR MIXING VS. PIGMENT MIXING

White light as we understand it is a combination of all the colors of the rainbow in just the right proportion to affect our visual sense with the impression of "whiteness." When such light falls upon various objects some of the light is absorbed and some of it reflected. The color of the light that escapes absorption we call the "color of the object." Thus, yellow paint appears yellow because it reflects mostly yellow light, while blue paint appears blue because it reflects principally blue light. Both yellow and blue paint, however, reflect some green light so that when mixed they absorb all colors but green.

When blue and yellow lights are cast upon the same white screen, they are both reflected equally well to the eye. There are processes induced by blue and yellow light affecting the eye in identical regions which seem to mutually inhibit each other, and neither process is effective in producing a sensation of color unless one or the other is particularly dominant. If pure colors are used and combined in just the right proportion, the screen will appear gray instead of either yellow or blue.

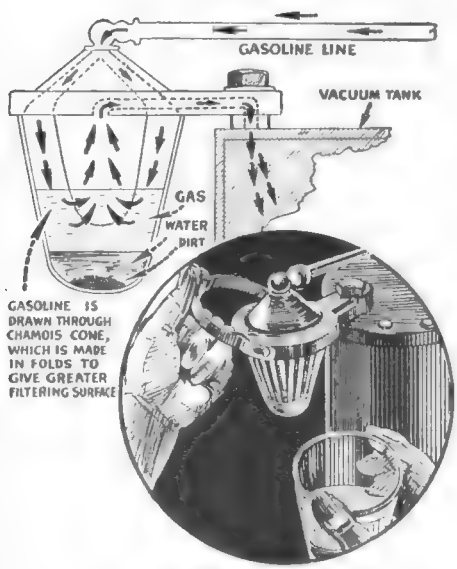
WHICH WOULD HURT THE MOST?

The energy of a moving body can be shown to be proportional to the mass of the body and to the square of its velocity. The kinetic energies of the two moving stones, then, would be in the ratio 2×30^2 to 3×20^2 or in the ratio 1800 to 1200 or three to two. Thus, the faster moving body would have half again as much energy as the slower moving one, and hence would inflict the most pain if it struck anyone.

FIRE AND WATER

An instance is known in which a round-bodied flask filled with water set fire to a blotter upon which it stood by concentrating the rays of the sun upon it just as a "burning glass" may be used to concentrate light upon a piece of paper and set fire to it.

GASOLINE FILTER



This interesting filter for autos strains all gasoline fed to the carburetor. Chamois is the filtering agent. The device is safe and insures perfect engine operation in all weather. Filters water and dirt.

EARLE E. LIEDERMAN
The Muscle Builder

How Long Do You Expect to Live?

Make your own answer. It's up to you. I know you might be hit on the head with a brick or be pushed off the end of a dock. But barring accidents, what then? If you take care of an automobile it will last for years—abuse it and you might as well cash it in after the first year. This is just as true of your own body.

IF YOU DO—YOU DIE

Go ahead with your careless living if you want. Eat and drink what you like. Abuse your body—it's yours to do with as you please. You may think you're having a good time. But are you? You get up in the morning feeling half dead. You drag yourself through the day. Don't you know your body is clogging up with poison? Don't you know your lungs are starving for oxygen? Don't you realize your inner cells are breaking down and you are not doing a thing to replenish them? You're dying, man—and you don't know it.

I ADD YEARS TO YOUR LIFE

You need exercise. You must have it. Tie your arm to your side and it will wither away—but use your muscles and you have more muscle to use. Every vital organ is completely surrounded with muscles which make those organs function. Exercise and you strengthen the organ itself. You wear down the dead tissue. The white corpuscles of your blood carry it off and the red corpuscles supply new healthy tissue. You drive death and disease out and bring new life to a worn down and famished body.

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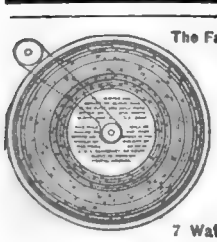

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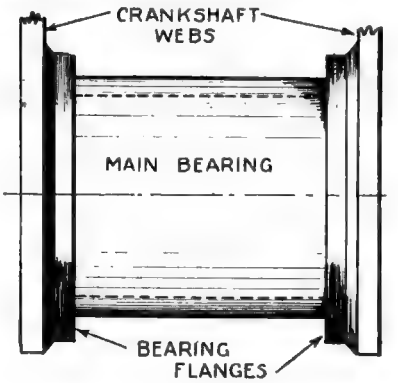

FIG. 1

One main bearing in every engine is flanged as shown above. Play between flanges and crank shaft web results in knock. New bearings may be inserted or repair made as in Fig. 2. This play should be the first thing taken care of.

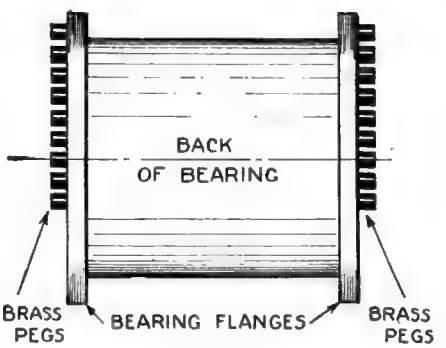

FIG. 2

To repair flanged main bearing, drill series of holes in ends of bearing, tap and insert small brass pegs as shown. Pegs are then filed down until main bearing will give snug fit between crankshaft webs.

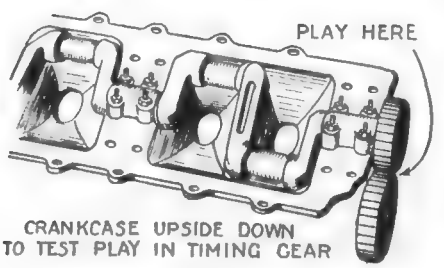

FIG. 3

Before scraping bearings, to take up up-and-down play, be sure that there is sufficient play in the timing gears as shown above. If not, every one of the main bearings should be raised slightly by means of shims, being sure to raise each bearing the same amount.

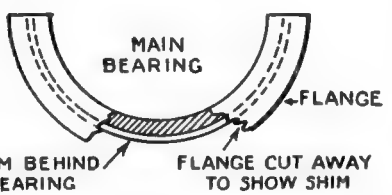

FIG. 4

Fig. 4 shows how shim material is placed under the main bearing to effect the repair mentioned above. Use no more shim material than is absolutely necessary.

(*Continued on page* 1163)

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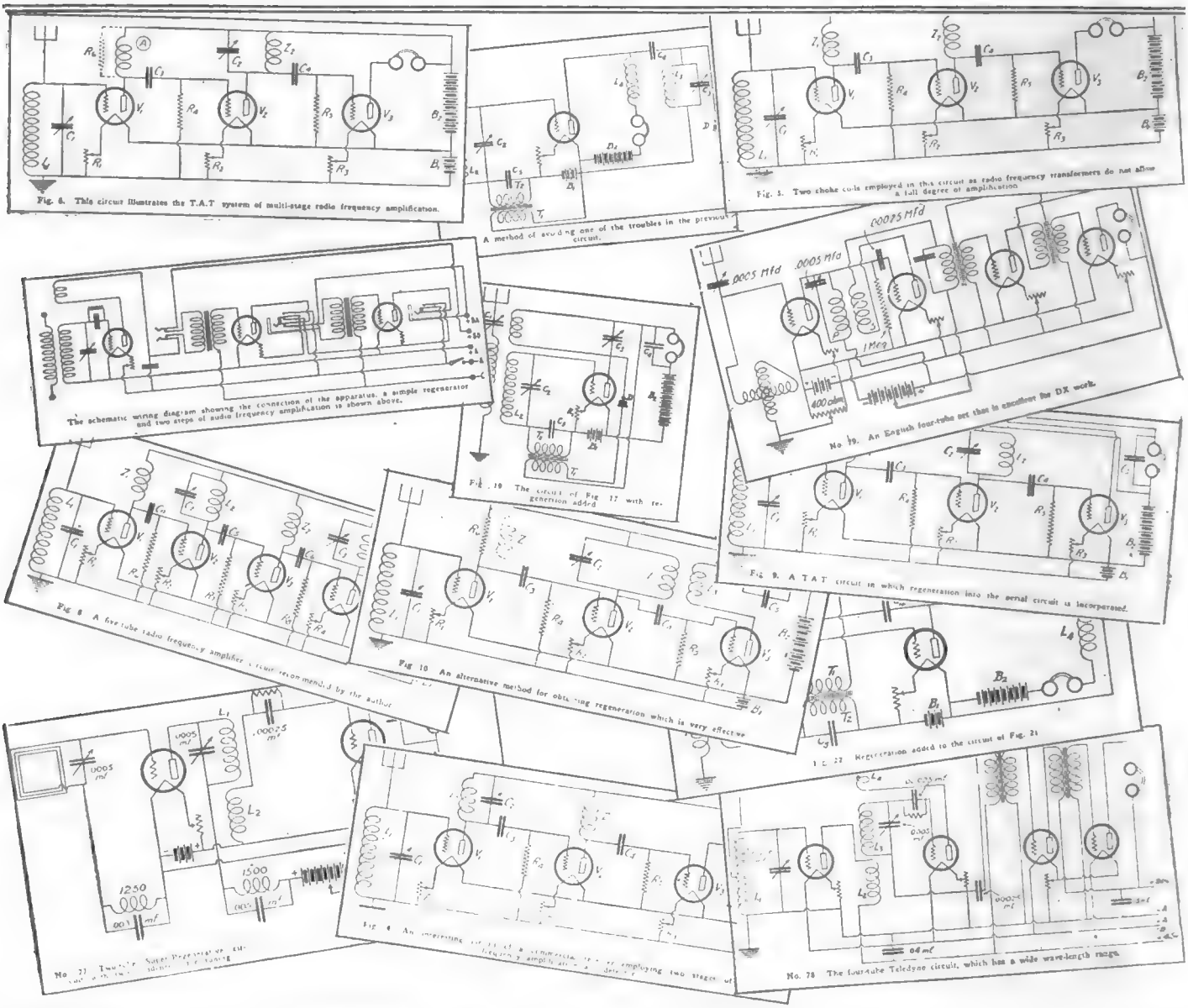

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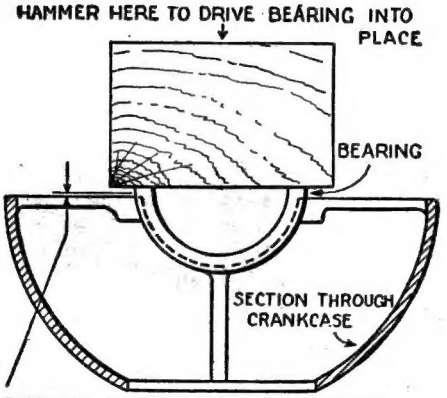
HAMMER HERE TO DRIVE BEARING INTO PLACE
BEARING
SECTION THROUGH CRANKCASE
DISTANCE BEARING MAY STAND ABOVE CASE, WHEN IN POSITION

FIG. 5

Replacing main bearing after inserting shims. Hammer on the hardwood block and if necessary file surface of bearing edges off.

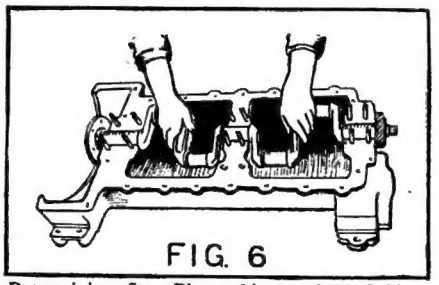

FIG. 6

Determining fit. Place thin coating of blue chalk on shaft, place in position, rotate and blue chalk is found on bearing high spots.

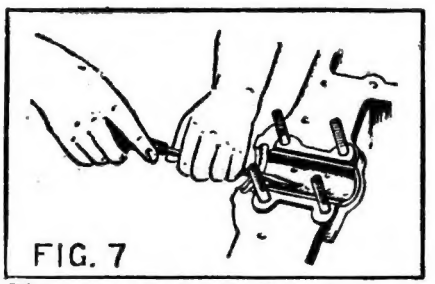

FIG. 7

High spots on bearing should now be scraped with bearing scraper and then tested again as in Fig. 6 until no high spots are found.

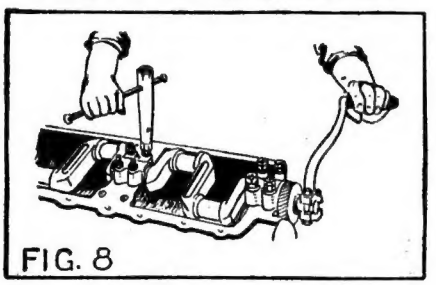

FIG. 8

Tightening bearing caps. Place chalk on caps and bolt in place. Rotate with handle fitted as shown. Scrape down high spots.

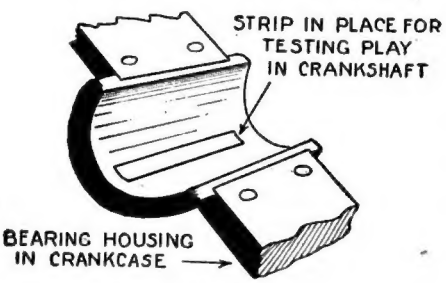

FIG. 9

Place quarter-inch wide strip of shim metal on bearing as above. If shaft can be easily turned, bearings are not tight enough. If slight drag is felt, bearings are fitted properly. Do not forget to remove shim metal.

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(*Continued from page* 1166)

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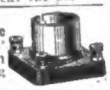

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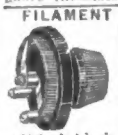

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RADIO "BAKELITE" PANELS

We supply genuine Bakelite, Condensite, Celeron or Formica, all of which have practically identical properties. Machines well without chipping. Won't warp. Waterproof. One side has attractive natural polished black finish which can be sanded and oiled. Other side mahogany finish. Either side may be used as front.

Panel Size Inches	⅛" thick Art. No.	Price	3/16" thick Art. No.	Price	¼" thick Art. No.	Price
6x 7	P450	$.55	P460	$.89	P470	$1.15
6x10½	P451	.86	P461	1.10	P471	1.60
7x10			P455	1.28		
7x12			P456	1.64		
7x14	P458	1.38	P468	1.73	P478	2.35
7x18	P453	1.78	P463	2.27	P473	3.15
7x21	P457	2.05	P467	2.65	P477	4.10
7x24	P459	2.42	P469	2.97		
7x26			P462	3.25		
9x14			P464	2.35	P474	3.15
12x14			P465	2.97	P475	3.98
12x21			P466	4.25	P476	5.70

COMPOSITION DIALS

Handsome dials moulded in one piece of polished composition. 2 inch size has 270° scale marked 0 to 100 finely engraved in contrasting white enamel. 3 and 4 inch size have 180° scale marked 0 to 100.

Black No.	Price	Diam.	Shaft Size	Mahogany No.	Price
P921	16c	2"	3/16	P926	19c
P922	16c	2"	1/4	P927	19c
P923	22c	3"	3/16	P928	26c
P924	22c	3"	1/4	P929	26c
P925	29c	4"	1/4	P930	34c

STANDARD BRAND LOUD SPEAKERS AND UNITS

P618 Brandes Table Talker.....$7.95
P616 Atlas Loudspeaker 21.95
P620 Baldwin Loud Speaker.....19.50
P603 Magnavox M4 Loudspeaker....21.00
P612 Magnavox R3 Loudspeaker....31.75
P614 Magnavox M1 Loudspeaker....26.50
P757 Morrison Adjustable Unit.... 4.35
P755 Genuine Baldwin Type C unit 4.75
P608 Atlas Unit. Each.....10.75

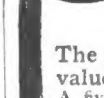
STANDARD BRAND HEADSETS

P754 Baldwin Type C.....$9.80
P764 Frost, 2000 ohm..... 3.50
P766 Frost, 3000 ohm..... 4.35
P751 Murdock 56, 2000 ohm..... 3.25
P752 Murdock 56, 3000 ohm..... 3.60
P768 Brandes Superior, 2000 ohm.. 4.85
P769 Brandes Navy, 3000 ohm..... 6.85

DUBILIER MICADON TYPE 601

P502	.0001..28c	P507	.0025..32c
P503	.00025..28c	P508	.003..40c
P504	.0005..28c	P509	.001..40c
P505	.001...32c	P510	.005..48c
P506	.002...32c	P511	.006..60c

DUBILIER MICADON 601G



Same style condenser as above with mounting for tubular grid leak. No grid leak included.
P581 .00025. Ea. 38c
P582 .0005. Ea. 38c

ANTENNA INSULATORS

P263 Ribbed Porcelain Insulator, 2½ in. long. Ea. 6c Dozen 55c
P265 Ribbed Porcelain Insulator—5 inches long. Each 15c

P263

STRANDED ANTENNA WIRE

Cabled of fine copper strands. Very flexible. High tensile strength. Best for aerials.
P248 100 ft. coil 56c P249 500 ft. coil $2.60

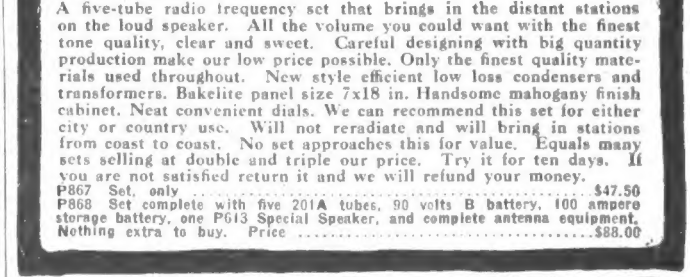
SUPERIOR RADIO SWITCH

P283 Each 29c
A switch fully equal to any on the market at a price about half what is usually asked for a switch of anywhere near equal quality.

SUPERIOR RADIO JACKS

Finest grade jacks. Improved design. Best materials. Phosphor bronze springs. Silver contact points. Nickel finish. Mount on panels ⅛ to ⅜ in.

P390 Open circuit. Each.....32c
P391 Closed circuit. Each.....39c
P392 Two circuit. Each.....49c
P393 Single circuit filament control..46c
P394 Two circuit filament control.....59c



5 Tube Bargain

The greatest radio value ever offered

A five-tube radio frequency set that brings in the distant stations on the loud speaker. All the volume you could want with the finest tone quality, clear and sweet. Careful designing with big quantity production make our low price possible. Only the finest quality materials used throughout. New style efficient low loss condensers and transformers. Bakelite panel size 7x18 in. Handsome mahogany finish cabinet. Neat convenient dials. We can recommend this set for either city or country use. Will not reradiate and will bring in stations from coast to coast. No set approaches this for value. Equals many sets selling at double and triple our price. Try it for ten days. If you are not satisfied return it and we will refund your money.

P867 Set, only $47.50
P868 Set complete with five 201A tubes, 90 volts B battery, 100 ampere storage battery, one P613 Special Speaker, and complete antenna equipment. Nothing extra to buy. Price $88.00

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Dealers send for our wholesale catalog.

PANEL MOUNTING VARIABLE CONDENSERS

These are especially high grade condensers and we guarantee them to be mechanically and electrically perfect. Fine polished end plates of heavy bakelite. Shafts ¼ inch diameter. Sturdy, heavy aluminum alloy plates perfectly spaced to insure smooth, even reliable capacity. Dial and knob on vernier type. No dial on plain type. Our low prices save you money.

No. Plates	Max. Cap.	Plain Type No.	Price	Vernier Type No.	Price
3		P815	$.79		
5		P816	.89		
11	.00025	P814	1.00	P825	$1.85
17	.00035	P817	1.20		
23	.0005	P813	1.30	P824	2.25
43	.001	P812	1.45	P826	2.46

GROUNDED ROTOR LOW LOSS VARIABLE CONDENSERS

P797 .0003 .....$2.75
P798 .0005 ..... 3.25
P799 .001 ..... 3.85
The most efficient type condenser made. Low losses, grounded rotor, straight wave line. Made of the best grade materials throughout. Heavy aluminum plates. Well insulated.

STANDARD BRAND VARIABLE CONDENSERS

P810 Acme .0005 Vernier.....$5.65
P784 Coto .00025 Vernier 3.95
P785 Coto .0005 Vernier 4.25
P786 Coto .001 Vernier..... 4.95
P787 Cardwell .00025 ..... 3.95
P788 Cardwell .00035 ..... 4.35
P789 Cardwell .0005 ..... 4.60
P790 Cardwell .001 ..... 5.50
P791 Marco .00025 ..... 3.95
P792 Marco .00035 ..... 4.45
P793 Marco .0005 ..... 4.95
P794 Marco .001 ..... 5.85
P795 Flewelling .00025 Vernier.... 4.50
P796 Flewelling .0005 Vernier.... 4.95

OUR SPECIAL A. F. TRANSFORMER

P549 3 to 1 ratio..$2.25
P550 5 to 1 ratio.. 2.45
In quality of tone and volume of sound, the things a transformer is built for, we guarantee it to equal or surpass any other transformer. Neat in appearance. Carefully made. Fully mounted with plainly marked binding post connections. Wonderful results on one, two or three steps without distortion or howling. A quality item in every respect.

OTHER STANDARD BRAND AUDIO FREQUENCY TRANSFORMERS

Fresh, Clean Stock in Original Containers.

P587 Thordarson Ratio 3½ to 1....$3.30
P588 Thordarson Ratio 6 to 1..... 3.70
P589 Thordarson Ratio 2 to 1..... 3.95
P590 Thordarson Push Pull. Pair..11.20
P531 All American 10 to 1. Each $4.25
P532 All American 5 to 1. Each 4.25
P533 All American 3 to 1. Each 4.05
P534 All American Push Pull. Pair 10.80
P535 Rauland Lyric 3.10
P553 Acme 3.95
P597 Erla 6 to 1..... 4.65
P598 Erla 3½ to 1..... 3.60
P591 Modern 10 to 1. Each..... 4.50
P592 Modern Push Pull. Pair..... 9.90
P555 Federal No. 226. Each..... 4.45
P556 Federal No. 65. Each..... 6.35
P712 Radio Corp. Each..... 5.70

STANDARD BRAND RADIO FREQUENCY TRANSFORMERS

P562 Dubilier Duratran $3.45
P565 Acme R2 ..... 3.95
P566 Acme R3 ..... 3.95
P567 Acme R4 ..... 3.95
P568 Erla Reflex No. 1..... 4.45
P579 Erla Reflex No. 2..... 4.45

RESISTANCE COUPLED AMPLIFICATION

P570 1st Stage Unit $2.30
P571 2nd Stage Unit 2.30
P572 3rd Stage Unit 2.49
Amplifies without distortion. Replaces audio frequency transformers using same circuit. Each unit consists of a mounting with condenser, grid leak and resistance of proper value for best results.

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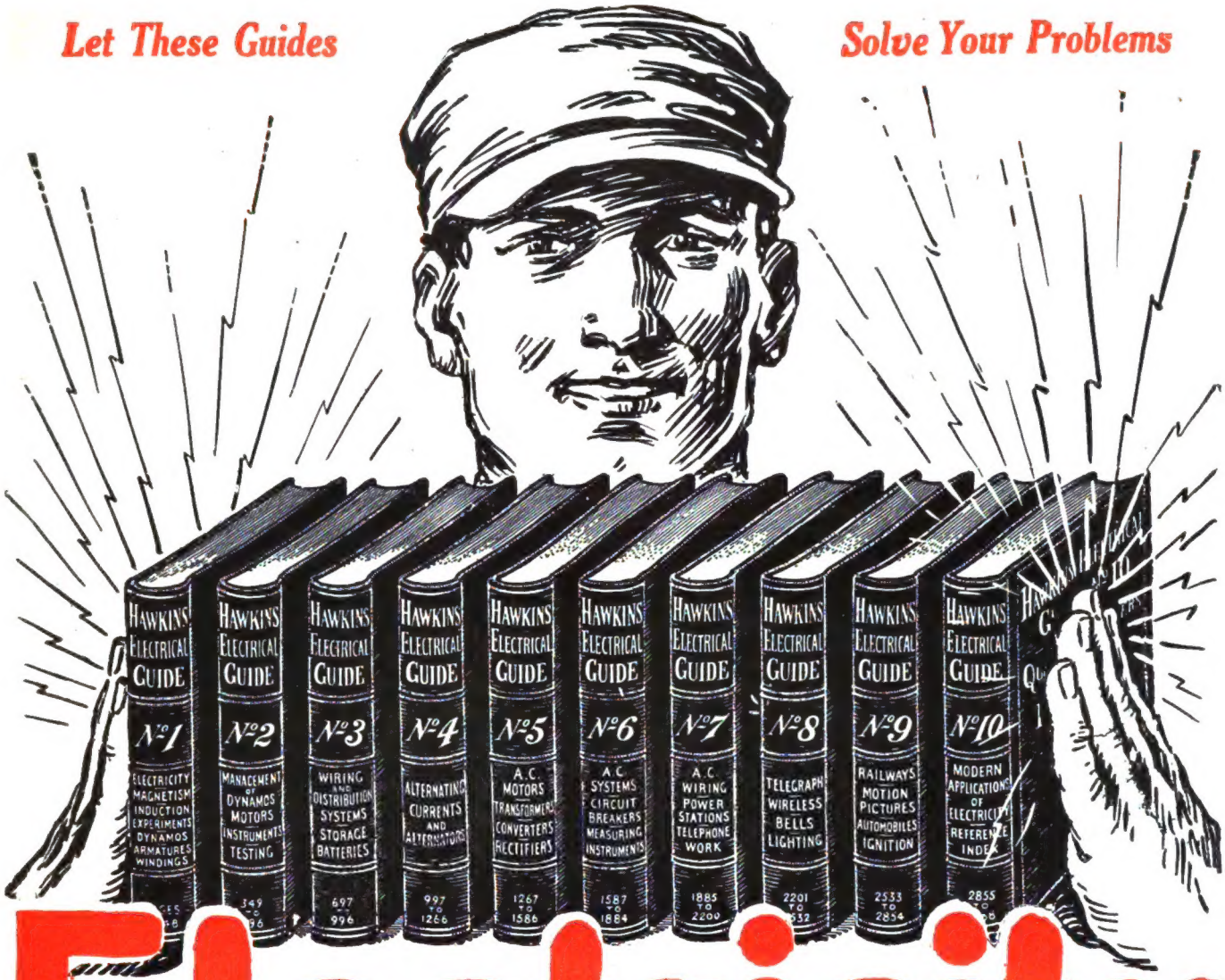

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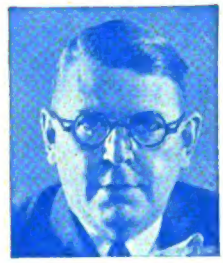

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